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The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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Contents

	PAGE
Ironbridge	157
Mental Pictures	157
Notes from the Branches	158
District Presidents.—No. 3	158
Random Shots	158
Oven Drying of Cores and Moulds	159
The New Unemployment Insurance Scheme—1934 Act	160
Iron and Steel Production	160
International Relationships and the British Foundry Industry	161
The "One-Pipe" System of Drainage in Buildings	162
Institute of Metals	163
Iron and Steel Institute	164
"Eclipse" Magazine Hack-Saw Frame	164
Oxy-Acetylene Welding at Olympia	164
A Completely Mechanised American Railway Brass Foundry	165
The Ecclesfield Works of Hall & Pickles, Limited	167
Queueing Up for Lead	168
This Week's News in Brief	170
Trade Talk	170
Personal	170
Obituary	170
Raw Material Markets	172
Patent Specifications Accepted	172

Ironbridge

When we learned privately, some time ago, that negotiations were on foot to schedule the cast-iron bridge across the Severn, at the place which subsequently came to be named Ironbridge, under the Ancient Monuments Act, we devoutly hoped that this would be done, and it is now an accomplished fact. The old bridge is now scheduled, and the Shropshire County Council is to erect another to take its place. We are somewhat uncertain as to the precise status conferred by this action, but we take it that no one will be allowed in future to interfere with or remove the bridge, which becomes a historic monument, which indeed it is. Whether it will continue to be used at all, or whether it will be replaced entirely by the new bridge, is probably not yet settled. The action has been taken with proper regard to all the interests involved.

In some respects Shropshire is the cradle of the iron trade, and the bridge, the first to be made in cast iron, was manufactured at the neighbouring Coalbrookdale works in 1777 and completed in 1779. Iron rails had been made at the same works some ten years earlier. The magnitude of the bridge, for it was a great undertaking at the time, created a profound impression, and it began a new industrial era. Other bridges were erected, notably the High Level bridge at Newcastle, over the Tyne, and their use to this day, in spite of the greatly increased weights and frequency of traffic, is great testimony to the faith and skill of the builders. The Bessemer and Siemens processes soon extinguished the use of ordinary cast iron for such structures, but the material has a history of which founders may well be proud. It retains its popularity for a thousand and one purposes, and extends its province as fast as if not faster than it is supplanted elsewhere. It is a good thing that it should be possible to preserve evidences of early development as a constant reminder to all of us, not only what has been accomplished in the comparatively short space of a hundred and fifty years, and how much still remains to be done. We wonder if there is in the industry to-day any person whose near relations were directly concerned with the production of castings for this bridge?

Mental Pictures

In his Presidential Address to the British Association for the Advancement of Science, Sir James Jeans once more discussed the position of modern physics and the philosophical implications of the modern conception of matter. The majority of people who are concerned in any way with scientific questions, however remote from pure physics, are by now familiar with the broad lines of thought for which theoretical physicists such as Sir James Jeans are responsible. The chief characteristic of this school of thought is a determination to be as indefinite as possible, and to point out to the layman and the applied scientist as often and as loudly as possible that we really have no idea at all what we are doing and seeing. The results of a particular experiment repeated several times are not to be predicted, nor can the phenomena be described in terms of familiar concepts such as space and time. As Sir Arthur Eddington, one of Sir James Jeans' distinguished fellow disciples of this doctrine, has expressed it: "Something unknown is doing we know not what." The methods of the physicists and chemists of but a few years ago, based on the painstaking development and refinement of mechanistic theories connecting cause and effect, expressible in the form of realistic mental pictures, are now decried as useless and misleading. In their place we are presented with a bewildering array of mathematical abstractions, on the grounds that the newer physical concepts cannot be adequately expressed in words.

Now this doctrine may quite possibly be an admirable guide to research in theoretical physics—to the extension of the very frontiers of knowledge—but on the other hand it must be remembered that this very same atomic physics is the ultimate basis of a great deal of our technological practice. Our whole technical and industrial fabric, nowadays so closely interwoven with scientific hypotheses and measurements, is based on nothing more elaborate than the certainty that a given set of physico-chemical conditions will invariably lead to the same result in accordance with some particular conceptual scheme or hypothesis. The phenomenon of slip or plastic deformation, for instance, which is the foundation of all metal-working processes and of the employment of metals as engineering materials, is a process dependent entirely upon atomic and electronic structure and properties, and thus subject, according to Sir James Jeans' school of thought, to this ban upon concrete, descriptive interpretation and determinism. It would not be too much to say that without the insight into this phenomenon which we have obtained through the medium of imaginative hypotheses or mental pictures, progress would have been greatly retarded in such diverse fields as those of the high-duty alloy steels and the deep drawing of sheet metal. The invaluable contributions

made by the late Dr. Rosenhain to the study of physical metallurgy were invariably based upon a theory giving a direct visual picture of the phenomenon, whilst, in a somewhat more fundamental field, such an authority as Lord Rutherford may be cited as a brilliantly successful exponent of such mechanical pictures in all his work on atomic structure. It is this latter work, in fact, together with the greater insight into crystal structure given by the methods of X-ray analysis, which has served as the foundation for the development of modern physico-metallurgical theory and its application to technical practice.

A preoccupation with technical practice should, indeed, be sufficient defence against this pernicious disease of indeterminism. In every branch of metallurgical industry the welter of detail is far too great to be handled without the aid of a constructive hypothesis framed by the use of the scientific imagination—a realistic representation of the phenomena in terms of such familiar ideas as mass, force and motion. The mind weaves an impression out of the observations and the previously accepted mental pictures of the stage farther back in the particular branch of science involved, with the result that the whole phenomenon under consideration may be realistically visualised and analysed. Only by this method can we obtain a better insight into a particular phenomenon and understand why the changes of which it consists take place as they do. Only in this way has any real increase in knowledge come about and any real advance in practice been made. Such pictorial representations give life and motion to what would otherwise be idle and detached thoughts, and act as stimulants to research and discovery. The example which comes to mind from foundry practice is the mechanism of graphitisation of cast iron. This process is definitely one having its original within the sphere of atomic physics, but at the same time it is the essential governing factor of the ironfounding industry. Are we to sit back and complain with the theoretical physicist that something unknown is doing we know not what, or are we to go on step by step (as, of course, a number of metallurgists are doing), developing, checking and revising a detailed mental picture of this phenomenon so that it may be brought under more precise control? The answer is only too obvious. Ultimately, no doubt, metallurgical theory will be in a position to avail itself of the work of the modern theoretical physicist, but before this happens the ghostly and bloodless abstractions in vogue to-day will have to be made presentable in terms of more realistic physical concepts.

Notes from the Branches

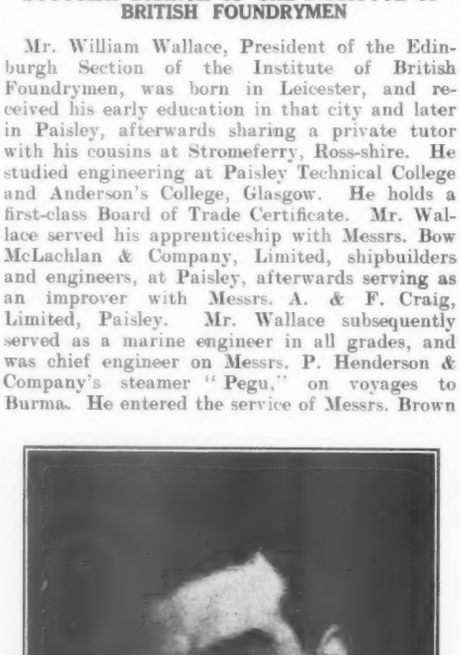
The members of the Scottish Branch of the Institute of British Foundrymen visited, at the invitation of the directors, the works of the North British Locomotive Company, Limited, at Springburn on September 4. Over 70 members attended and were conducted in small parties through the iron and brass foundries and engineering shops by the officials and heads of departments. Particular interest was evinced in the methods of moulding of locomotive cylinders and in the very fine examples of welding adopted. At the conclusion of the visit the officials were cordially thanked for their efforts to make the visit interesting as well as instructive and the directors for their permission to make the visit.

APPLICATIONS TO THE Railway Rates Tribunal for the approval of agreed charges under the provisions of the Road and Rail Traffic Act, 1933, include one by Messrs. Hepworth & Grandage, Limited, Bradford, and the L.N.E. and L.M.S. Railway Companies in respect to "motor-engine parts, such as pistons and rings."

District Presidents.—No. 3

SCOTTISH BRANCH OF THE INSTITUTE OF BRITISH FOUNDRYMEN

Mr. William Wallace, President of the Edinburgh Section of the Institute of British Foundrymen, was born in Leicester, and received his early education in that city and later in Paisley, afterwards sharing a private tutor with his cousins at Stromeferry, Ross-shire. He studied engineering at Paisley Technical College and Anderson's College, Glasgow. He holds a first-class Board of Trade Certificate. Mr. Wallace served his apprenticeship with Messrs. Bow McLachlan & Company, Limited, shipbuilders and engineers, at Paisley, afterwards serving as an improver with Messrs. A. & F. Craig, Limited, Paisley. Mr. Wallace subsequently served as a marine engineer in all grades, and was chief engineer on Messrs. P. Henderson & Company's steamer "Pegu," on voyages to Burma. He entered the service of Messrs. Brown



MR. WILLIAM WALLACE.

Bros. & Company, Limited, Rosebank Ironworks, Edinburgh, in 1911, as a draughtsman. He became engineer in charge of outside contracts in 1912, and in the same year assistant manager. He successively filled the positions of joint manager, manager and director, and in 1917 became managing director, a position he still holds. Mr. Wallace has specialised in ships' auxiliary machinery, and has designed and owns patents for electro-hydraulic steering gears which have been installed in a large number of the latest and most important ships afloat. He personally completed the designs for the "Aquitania's" steering gear, which at the time was the largest steam-steering gear in the world.

Mr. Wallace has been for the past 12 years chairman of the East of Scotland Engineering Employers' Federation. He is a member of the Institution of Naval Architects, the Institution of Marine Engineers, member of the Institution of Mechanical Engineers, and is a member of council of the Institution of Engineers and Shipbuilders in Scotland and a Past-President of the East of Scotland Association of Engineers and Shipbuilders.

THE NORTH-EASTERN MARINE ENGINEERING COMPANY, LIMITED, Wallsend and Sunderland, have obtained a contract for removing the turbine machinery from the steamer "Bexhill" and replacing it with superheated triple-expansion machinery.

Random Shots

One quality of Miss Nellie Snookers that "Marksman" particularly admires is the promptitude and energy with which she plunges into Modern Markets. If the foundry industry as a whole were to emulate her, it would make a much bigger splash in more ways than one. The latest Modern Market she has entered is the road-stud business. Now that safety crossings for pedestrians are being adopted all over the country, and what is more are to be made a permanent feature by the replacement of painted lines by metal studs, Miss Snookers considers that here is a profitable outlet for the special Gayway road studs which have recently been evolved by her.

* * *

The production of Gayway road studs calls for the use of a completely new alloy of unique properties. This metal, which has been given the brand name of "Phosfoglow," is essentially a steel with stainless properties which has an abnormally high phosphorus content. This phosphorus is present in such a state that its phosphorescent qualities are retained. It will be seen therefore that road studs made of "Phosfoglow" will glow distinctly when in darkness, and the advantages of this are of course so obvious as not to need comment. The design of the studs has been very carefully considered. The diamond pattern was rejected on the grounds that bridge players, homeward bent, have been known to stop in the face of oncoming traffic, and have met a sudden end whilst producing a trump card from their sleeves. The conventional circular form was finally adopted, with a chisel-like shank for driving into the road.

* * *

Important as the road-stud business has become in the Gayway Foundry—the production figure is now 25,000 a day—Miss Snookers is convinced that the field of application of "Phosfoglow" will rapidly widen. One use springs to mind immediately—for motor cylinders. Has your car ever broken down at night, miles out of town, and you have felt for matches, lighter or torch, to find that the world is left to darkness and to you? If that experience has been yours, you will by now be writing to Miss Snookers, pleading for an experimental "Phosfoglow" cylinder block.

* * *

When Miss Snookers first discussed "Phosfoglow" with "Marksman" the thought occurred to him that "Phosfoglow" door-knockers would be a boon and a blessing to strayed revellers. That, he has discovered, would not be so. Much better would be the "Phosfoglow" latch-key. Though "the night hath a thousand stars," they are of precious little assistance when one is trying to find a latch-key which has dropped through not-so-steady fingers on to the gravel path (and the wife happens to be a light sleeper)! And the front-door key-hole disc should be made to match the key.

"MARKSMAN."

Mechanical Resistance of Steels Exposed to Corrosive Gases

I. MUSATTI and A REGGIORI, in "Chimie et Industrie," describe creep tests on 18-8 Cr-Ni steel and 13-0.4 Cr-Mo steel at 500 to 800 deg. in air and sulphur dioxide. In this gas, the first-named steel is only superficially attacked in the absence of any applied tensile stress, and the creep limit also unchanged. Rapid failure, however, occurs on applying a tensile stress, which is ascribed to the penetration of the sulphur dioxide along the crystal boundaries where the carbides are precipitated. Maximum disintegration occurs at 650 deg., and this intercrystalline fracture occurs without preliminary warning. The second steel withstands the action of sulphur dioxide at high temperatures, a surface attack alone being observed.

Oven Drying of Cores and Moulds

MR. FIEGEHEN ON CANADIAN CONDITIONS

When the Paper from MR. FIEGEHEN was presented to the Manchester Conference of the Institute of British Foundrymen, it was particularly well received, as it was the first contribution ever made by an authority from the British Dominions, whilst its technical excellency was unquestionable. The Paper was printed in our issue of July 12, 1934, and the discussion on page 57 of our issue of July 26, 1934. The author's reply has now been received from Canada, and is a particularly illuminating account of Canadian foundry practice. Mr. Fiegehen writes:—

In replying to the discussion upon this Paper, the author wishes to make it clear that his approach to this subject has been purely that of a mechanical engineer, with no special knowledge of foundry practice.

The necessity for improved core and mould drying methods became acute in connection with a contract for a quantity of cast steel runners, for Francis-type hydraulic turbines of 50,000 h.p. The mould for such runners is made by grouping a number of interlocking moulds or cores, on a base-plate in a casting-pit, the group being surrounded by a steel-plate supporting shell between which and the cores sand is rammed.

The cores or mould-segments must be true to dimensions and undistorted. Owing to the large dimensions of these cores, it became necessary to construct a special duplex drying-oven, consisting of two chambers, each approximately 15 ft. cube.

The construction consisted of steel plate shells enclosing 4 in. of rock-wool insulation. The roofs were removable, for crane service, and a combustion chamber for oil-firing was located below each oven.

One core, such as those shown in Fig. A, formed a charge for each chamber, and was built upon a special base-plate. These cores were moulded in a built-up core box, to which sections were added as the work proceeded in height.

The matrix was a special core-arbour, built up to the approximate contour and held rigid by a bracket, that can be seen in the photograph (Fig. A) bolted to the base-plate. Moulding was done with the aid of air-rammers, using sharp Ottawa sand. A characteristic sand mix is as under:—1,600 lbs. sharp Ottawa sand; 58½ lbs. fireclay; 9 lbs. "Rex" corn binder; 1 gall. of molasses; ¼ gall. of fuel oil. This was milled for 10 min. and had a moisture content of 4 to 6 per cent.

Particulars of a set of cores are as under:—

Core no.	Weight each.	Average thickness.	Drying time.	Weight of coke in centre.
	Lbs.	Ins.	Hrs.	Lbs.
1	46,000	30	70	1,500
2, 3 & 4	24,000	21	60	500
5	60,000	66	80	2,000

The cost of these cores, when ready for the oven, was very considerable, and a regular supply to the moulders was essential. They were to be baked without cracking and distortion, with a reasonable fuel cost and with full control of the process.

A search was made through technical literature, for guidance, and a description of the drying of wet whiting, by the three-stage "humidity-drying" method was found in the handbook of the American Society of Heating and Ventilating Engineers.

The problem in hand differed, in many respects, from this, but the principle of re-circulation and the "water-shield" method of protecting cores and eliminating cracking seemed to be sound and much in advance of current practice. Cracking and distortion were the chief risks to be overcome.

Each drying chamber was therefore provided with a motor-driven fan, connected to the interior by sheet-metal ducts, arranged to draw the air from the top of the oven and re-introduce it at the bottom. Each fan was of sufficient capacity to ensure about 20 changes of air per hr., and the ducts were designed for a low velocity and shaped to ensure an even distribution of air; vents and dampers were also provided.

There was some anxiety over the fate of the first two cores, for time did not permit of preliminary experiments, but, fortunately, the results throughout were very satisfactory.

The oven temperatures, as recorded, were substantially the same as those described in the Paper, for each stage of drying. Based upon this experience, the old-style ovens in the plant are being equipped for re-circulation; all use oil-fuel, which is cheap in Canada and needs little attention. This plant produces steel castings only, has a complete sand-conditioning and handling equipment, and most of the cores are moulded on jolt machines.

FIG. A.—CORES FOR FRANCIS-TYPE HYDRAULIC TURBINE WHEELS OF 50,000 H.P.

Referring to DR. SKERL's remarks, it will be evident that, the sand grains being impermeable, all the water content of the green core must be located entirely in the voids of the core, and thus the permeability of a hard-rammed core, for steel casting, when in the green state, must be very low, and the reduced heating in the third period may lessen the risk of cracking, by preventing the accumulation of steam pressure.

In the first period, the automatic limitation of the surface temperature to 212 deg. F. keeps the temperature gradient in the core moderate (as compared with "toasting" methods), and thus tends to prevent cracking, due to differential expansion, especially at rapid change of section.

Inquiries were circulated for a humidity indicator and recorder, suitable for core-oven use, but none was offered for a higher temperature than 212 deg. F., except by the indirect method of extracting a measured sample of the air, cooling it, measuring the humidity at the reduced temperature, and calculating, from this, the humidity in the oven; this could not be attempted under foundry conditions.

Large cores, such as those described, are not dried throughout, and it was desired to have a means of measuring the percentage moisture content at different depths. An electric moisture detector was secured, designed for lumber grading, and its needle-point contacts were replaced by contacts, at the end of an insulated probe, which was thrust into the core.

The results were not sufficiently encouraging to place any reliance upon them, but it was thought that by re-arranging the detector circuits for the small range of humidity required and by devising some means of protecting the electrodes from moisture, until the desired depth was reached, and especially of ensuring uniform contact conditions, such an instrument could become of great value.

Mr. Smith will understand that the author is only qualified to discuss the mechanical aspects of the points he has raised, but he is able to agree with him that, to secure uniform temperature distribution in ovens and furnaces, careful attention to the circulation of the heated gases is essential.

The actual flow of the gases, past the obstruction of the contents of an oven or furnace, is by no means easy to predict. In the case of the special core-ovens described, we were able to secure useful information and guidance, on this point, by injecting smoke, through the burner port, into the combustion chamber, and observing its movement, in the oven, through sight-holes provided in the wall, the interior of the oven being illuminated, for the purpose, by electric lamps.

Mr. Smith is correct in stating that considerable core loss was involved in the days when cores were baked, in a hurry, at temperatures of 315 deg. C. or more without circulation; it is true that foundrymen developed mixtures that would stand up, fairly, to such harsh treatment, but the true remedy is controlled circulation.

All our ovens had an oil-fired combustion-chamber below the floor, and the escape of the hot gases, upwards to the oven chamber, was made uniform by arranging the line of flue openings, along each side wall, of increasing area, from the burner to the last opening, the intention being to make the total friction up to each outlet, and consequently the flow of gas, constant at all openings.

Pressures in these ovens were always slightly above atmospheric to prevent inflow of cold air. This pressure is due to the injector action of the oil-burners; the circulating flow is practically balanced.

The penetration of hot air into cores, due to pressure, to which Mr. Smith refers, can only take place for a moment, until the external pressure is balanced, when it ceases.

The best method of heating the centre of cores is by conduction through the contained water, as arranged in the first period described in the Paper.

The function of re-circulation, in the first period, is solely to equalise the temperature in the oven, the dampers are closed so that the same air is used over and over again; it does not matter how saturated it is with moisture—we want it so to protect the surface of the cores whilst heat is penetrating, conducted by the internal moisture.

It would appear to be very uneconomical to dry large and small cores in the same batch, undoubtedly it can be done.

To Mr. Tipper's three essential factors in drying, the author would add a fourth—moisture control.

His third item appears to have been incorrectly reported; the oxygen in the core stove is needed for combustion of the fuel, whilst in the oven it is available for oxidising the binders.

With an air supply corresponding to 20 changes of oven capacity per hr., ample oxygen should be available, and it is partly for this purpose that the air-dampers are opened, in the second period.

Replying to Mr. Molineaux, it would appear that the successful drying of over 60 very large cores, without detrimental cracking or distortion, was evidence that there must be some merit in the wet-surface theory, applied to the first period of drying.

Obviously, the drying of a water-bearing core depends upon evaporation, whilst the drying of an oil-sand core is mainly a matter of oxidation—both demand re-circulation of air, but only in the former is the water-shield idea applicable.

Continuous ovens are restricted, chiefly by considerations of length, to the drying of small and medium cores, requiring a moderate time for baking.

The combustion chamber is usually located between the conveyor passes and the core-tray carriers pass through constrictions or "throats," rather longer than the pitch of the carriers; the sealing effect of the throats, owing to small clearances, is fairly good.

Part of the path of the conveyor is sometimes devoted to a cooling area, and the heated air, from this, is used as combustion air to the burners, thus improving the thermal efficiency somewhat.

American makers now offer re-circulation in these ovens and, having regard to the possibility of dividing the path of the conveyor into sealed compartments and to the extreme slowness of movement, it would appear mechanically possible to provide for all three heating periods in sequence. Continuous ovens show to best advantage, of course, in mass-production foundry programmes.

Mr. West's remarks, regarding linseed oil, are very interesting, possibly the observations published by the American Foundrymen's Association, stating that oxidation is very much faster between 175 and 230 deg. C. than at lower temperatures, is an indication of polymerisation in the samples under test, and it is known that linseed oil samples vary greatly.

Further, one would assume that the statement, "at 260 deg. C. the qualities of the oil are destroyed," refers to its bonding properties, which may reasonably have some relation to its volatile constituents, which with increasing temperature are driven off.

The New Unemployment Insurance Scheme—1934 Act

Perhaps the most important principle of the Unemployment Insurance Act, 1934, is that it divides the scheme into two definite parts, the insurance sections and those concerning unemployment assistance. The insurance sections are already in operation, but the date of commencement of the assistance provisions is at present problematical. It will not be for some time.

Insurance Benefit Conditions

The first and chief condition for the receipt of insurance benefit is proof of 30 contributions paid in the two years prior to date of claim to benefit. Disability-pensioned Service persons prove ten. There are other conditions simple for the average person and there is a fifth condition which may make benefit dependent on attendance at a course of instruction for persons under 18, or a training course for persons 18 and over.

Duration of Benefit

Conditions proved, insurance benefit is payable for 156 days in a benefit year to all persons. Extra benefit can, moreover, be drawn by persons who have been insured for at least five insurance years, reckoned from the beginning of the year in which the first contribution was paid, called "additional days" benefit. The extent of this benefit is determined by the number of contributions paid in the five insurance years preceding the beginning of the benefit year in question. Three "additional days" are given for every five contributions paid in that period, less one day deducted for every five days' benefit drawn in the benefit years ending in the five insurance years of test. It will be seen that a person registering 260 contributions would be eligible for insurance benefit for twelve months; 260 gives 52 units of five contributions which at three "additional days" per unit, gives 156 "additional days" plus 156 days ordinary benefit, thus twelve months' benefit. Suppose a person only registers 200 contributions in the five years, he would receive 120 "additional days," and if he had received 300 days' benefit, 60 "additional days" would be available as follows. Two hundred contributions give 40 units of five contributions, which, multiplied by three, gives 120 additional days, but 60 days deduction would operate by 300 days' benefit previously received, giving 60 "five-day" periods, which at one day a period would mean a deduction of 60—thus that person would receive a total of 216 days' insurance benefit (156 ordinary days plus 60 "additional days"). When benefit rights are exhausted, no more insurance benefit can be drawn in that benefit year in any case, but from the commencement of the next benefit years and so on *ad lib* the right of 156 days plus any additional days is revived, provided that ten further contributions have been recorded, and also that at the relevant date the 30 in two years rule is also met. The right to 156 days and any additional days is present year by year if conditions are fulfilled, but as regards additional days, it might be useful to note that if in five consecutive insurance years no contributions are registered, the five-years insurance rule must be again met before right to additional days is again present, the commencing date for this period being determined by the first stamp of any subsequent employment. It should be distinctly understood that for a benefit year there are no common commencing and finishing dates for all persons. A benefit year is particular to each person. A benefit year commences to run from the date when the 30 in two years rule is first met; if unemployed at the year end the next benefit year would start on the anniversary date. If a benefit year has terminated before unemployment again occurs, that benefit year would start from the date when the 30 in two years rule is again met. In the case of a person who has exhausted his benefit rights in any year, if the ten contributions have not been registered at the year's end the next benefit year will not commence until the ten-contributions rule has been met. Of course, if the further ten contributions have been registered during the year, the next benefit year would commence at the anniversary date, if the person was then unemployed. If a person, although eligible for insurance benefit refrains from taking his full total of days, say stopping at 150, 152, and so on, and it is proved that the reason for so doing was to obviate the fulfilling of the ten further contributions rule, those days may be deemed to have been paid and added to total, so that the re-qualification rule would be necessary to revive right to insurance benefit.

Important Points

The Minister has wide powers as regards the making of Regulations. By this method he may require all boys and girls 14 to 18, insured or uninsured, to attend an authorised course in certain circumstances. By Regulations to be issued also employers will be required to report to the authorities, when any boy or girl 14 to 18, insured or uninsured, leaves their employment.

Persons under 16 years of Age

Boys and girls 14 to 16 are brought into the insurance field, the full contribution being 4d. weekly, but 2d. of this is recoverable from the employee. Benefit, however, will not be payable until the age of 16, even though the child concerned can fulfil the condition, but if a boy or girl is unemployed, the person who is responsible for their upkeep may draw the 2s. children allowance, the same as if the child is at school or invalid, provided that the boy or girl concerned has not broken any of the insurance disqualification rules and that the adult claimant is eligible for benefit.

General

Until the Unemployment Assistance sections come into force, a person who exhausts his Insurance Benefit, and requires any more payments in that benefit year must apply for Transitional Payments as now, when a "needs test" must be passed. This also applies to those persons who cannot meet the first contribution rule but can substitute a lesser contribution test. When Unemployment Assistance operates, there will be no contribution test, the main condition being proof that the normal occupation of the person was one which came (or would do) under the Pensions Acts; these Acts include many more occupations than the unemployment insurance scheme, so more people will be eligible for allowances.

Iron and Steel Production

The British Iron and Steel Federation, in its "Statistical Bulletin" for July, states that the production of pig-iron and steel in the United Kingdom in July continued to be maintained at approximately the same rate as in the past few months, but owing to the holidays in Scotland, production of steel ingots and castings fell from 757,500 tons in June to 718,200 tons in July. The production of pig-iron amounted to 528,300 tons in July, compared with 514,900 tons in June. The number of furnaces in blast at the end of July was 99, one furnace having ceased operations since the beginning of the month. According to returns received from 153 firms, employing 120,570 workpeople, the average weekly earnings per head in June amounted to £3 2s. 2d., compared with £3 0s. 11d. in May and £3 0s. 7d. in April.

THE JAPAN STAINLESS STEEL COMPANY, LIMITED, has decided to erect a works at Naoyetsu, Niigata-Ken, with a capacity at the outset of 5,000 tons of stainless steel per annum.

International Relationships and the British Foundry Industry

At the opening meeting of the London Branch of the Institute of British Foundrymen, Mr. H. S. Beech, the newly-elected President, delivered his address, in the course of which, after thanking the members for his election, he said he had found great difficulty in discovering some interesting subject to put before the members. This difficulty was quite easy to understand, because it was only given to extraordinarily brilliant people to be appointed President of various institutions, on several occasions, that the composing of presidential addresses comes to them with ease. To an ordinary layman, like himself, it was an honour coming probably only once in a lifetime, and needed considerable preparation and thought. A chance remark, however, made by a friend of his some six or eight weeks ago, indicated a line of thought which he hoped to be able to develop into an interesting topic.

This gentleman desired to know the line of development which is probable in the next ten years in the foundries of this country. Not being a prophet, Mr. Beech refused to be rash enough to prognosticate in any way. Conversely, if consideration was given to the events of the last twenty years in the foundry industry, they might perhaps gather some interesting data. It must be apparent, however, that if they could utilise such data to enable them to use foresight, it might prove of the greatest possible value. It should serve a useful purpose to review briefly the period from the commencement of the Great War to to-day. In doing this, it should be remembered "that a little forethought will save much afterthought," and, moreover, "that men who fail act without foresight."

In 1914, therefore, conditions found the foundries of this country, generally speaking, in a lamentable condition. They were looked down upon by the management as necessary evils. They were, generally speaking, looked upon as dirty, undesirable sorts of places, and it was only after the outbreak of war that it was realised that the foundries held the key to the entire production of munitions and to the making of machinery for the production of firearms, munitions, preparation of foodstuffs, and to every conceivable purpose for the successful prosecution of the war and to feed the army and navy and civil population.

Before the war, it was common knowledge that every year a large tonnage of castings in all metals was purchased abroad and imported free of all tariffs into Great Britain, at prices which our foundries, due to their poor support from the management and poor equipment, could not compete against. The war stopped all this importation, and feverish steps were taken to equip British foundries so that they could produce the enormously increased tonnage demanded.

This equipment consisted mainly of plant which could be manufactured over here, or that which could be extracted by overwhelming persuasion from the works of our allies.

How the industry responded against superhuman difficulties to the demands made upon them from 1914 to 1918 must always stand to the everlasting credit of the foundry industry of Great Britain. Without that gigantic effort the war could not have been brought to a successful conclusion. Anybody who went back to the shops on November 12, 1918, must have quickly realised that another revolution, almost as great as the one referred to above, was going to take place. Government contracts had to be rapidly wound up and settled, and then a complete turnover from the production of munitions to castings required for peace-time pursuits. Industry was still faced with the fact that although our foundries were perhaps better equipped than they were at the outbreak of war, the foreigners in both allied countries and those countries with whom we had recently been at war, were trying to get our home market back again, particularly as it was practically the only large, free, open market left to them in which they could dump their surplus productions.

In addition to this, industry had to try to take back into industry, as far as it was able, the demobilised soldiers returning to civil life. Moreover, there was huge leeway to make up, for goods of every possible description, and a further difficulty we had to face, was the industrial unrest, which was, after all, a rather logical aftermath of the war.

Trade therefore was quite good during 1918, 1919 and in the first six months of 1920, and there were people, without foresight and without understanding the real situation, who thought that the demand for castings would last for ever, or at least for a very long time. They lost sight of the fact that foreign countries had built gigantic tariffs walls against us, and our pre-war clients in our overseas markets had been compelled during the war to put down their own plant for making the goods which we used to supply to them in pre-war days.

Post-War Developments

They also did not seem to understand that the enormous increase in direct and indirect taxation in Great Britain was slowly but surely swallowing up all reserves and destroying the purchasing power in the home market. All these things started the slump towards the middle of 1921. This depression, aided by railway and coal strikes, wended its weary way through 1922 and 1923, but in 1924 trade started to improve slightly and foundry owners who had foresight started to think hard about improving production. News was in the air about mechanisation of foundries in America, France, Belgium, etc., and as competition in castings was coming particularly from the Continent, certain progressive men over here considered it necessary to investigate the entire situation.

Trade continued to improve slowly but intermittently from the end of 1926 to 1929, after which we, like other nations, were caught in the world depression, from which we now seem to be slowly emerging. This trade depression was, without doubt, the result of a combination of factors, such as the aftermath of the war, the excessive taxation, which was certainly draining industry of its life blood, the huge tariff barriers and the strangulation of international trade.

Recent history records the Government crisis of 1931, of our being forced off the gold standard, about the election of the National Government, and finally the imposition by Great Britain of tariffs, quotas and more trade barriers and embargoes. Then came the efforts of our politicians at Ottawa, the reduction of unemployment, the balancing of the budget, whilst the demand for British goods has increased. All this has been leading to the crux of this address.

Mr. Beech asked his hearers to believe that he had no pretentions towards politics and he was not attempting to preach any political policy, he was only touching on this question as and when it concerns the foundry industry, in which they were all interested. There were, despite the improvement in trade, still about 2,000,000 people out of work in this country and unless a miracle happened he could not see how we could expect to absorb those people into industry. The only possible hope was to recapture our export trade and maintain it at the same proportions of our pre-war basis.

It must not be forgotten that we, as a nation, were compelled to safeguard ourselves against the inroads which the foreigner was making into our free market. The foreigner was exploiting this open large market with all possible energy, but there is no doubt that the improvement which has been evident in trade during the last 18 months is due to the improvement in the home market, and not in the export trade.

It was suggested that the whole human race is making a serious error in erecting international trade barriers, in instituting quotas, in placing embargoes and restrictions on trade, and, finally, in taxing foreign goods of any description whatsoever. By special design of providence, it will be found, if carefully examined, that every country in the world made certain products more efficiently than those of other countries, and no country in the world could truthfully claim that they produced all classes of goods better and cheaper than any other nation.

If all restrictions, tariffs and subsidies were swept away, and coinage and wages brought to the same level all over the world, each country would supply the other nations with products in which it was pre-eminent. We would thus obtain the very best goods at the lowest economic and commercial price, and, moreover, we should, not possessing the artificial protection of a trade barrier or tariff, be compelled to keep our works and equipment up to date, or we should very quickly be swept away with the open and free competition from other nations. The President was convinced that this free international trading pact amongst the nations of the world was much nearer than most people anticipated. Moreover, until all these artificial barriers were dispersed, there was very little hope for the continued prosperity of this country and the rest of the world.

If Britain is to sell to the world, it must buy from the world, and doubtless serious people in many countries are rapidly realising this. This state of affairs would involve another revolution in the foundry industry.

This, then, was the answer to the man who asked for a prophesy, and whilst he did not expect a reply on these lines, it was suggested that if the British foundry owner eventually obtained the chance of entering every market in the world with his products, and also at the same time had to fight the foreigners at home and abroad on an equal footing, it was necessary for him to see his foundry kept up to date. "Do not," said Mr. Beech, "if you are suddenly faced with such a state of affairs, find yourself in the position of the foundries of 1914."

Even if this prophecy be wrong, no harm could be done to the individual or to the trade by keeping oneself abreast of the times, both in respect to equipment and scientific, practical and metallurgical knowledge and practice.

He was, however, convinced that within the next few years industry would have to face the situation which had been outlined, and as a final message he gave two quotations: "Set your eyes to observe and your mind to understand," and, above all, "keep your powder dry." There was no doubt that these artificial and annoying restrictions between various nations caused the seed of ill-feeling, both individually and internationally to flourish exceedingly.

Vote of Thanks to Branch President

Mr. C. H. Kain (Past Branch-President), proposing a vote of thanks, said that the members of the Branch could congratulate themselves upon their new President, whom they had known for many years as a first-rate foundryman. His address had indicated that he was also a bold man, even though they might not all agree with him entirely.

Mr. F. O. Blackwell (Senior Branch Vice-President), seconding, said that people of one political persuasion had for many years advo-

(*Concluded on page* 164.)

The "One-Pipe" System of Drainage in Buildings

By D. Macintyre-Keir

Deviations from the orthodox system of plumbing are bound, sooner or later, to affect the iron trades. The experimental "One-Pipe" system of drainage in buildings recently installed at the Cumberland Hotel, Marble Arch, London, therefore, with some comparisons with the system operative in New York, will be of particular interest to that branch of the industry engaged in the production of light castings.

The "One-Pipe" system is a simplification of plumbing. It obviates the necessity for separate waste lines and concentrates all discharges (except R.W.) in a single stack. It reduces the number of traps to a minimum, provides a more efficient and hygienic system, effects a measure of economy, and enhances the appearance of the building. On the other hand, it calls for a rigid application of the ruling maxims in drainage design, a grouping together of fixtures to obviate multiple vertical stacks and the necessity for long branches to reach them; the provision of ready accessibility in the event of anything going wrong; the accurate proportioning of anti-syphon branches between the fixture and main vent; the provision of traps which will be self-cleansing and, at the same time, have a sufficient depth of seal to prevent un-syphoning by evaporation, momentum or compression, but above all, in its practical application it calls for the best type of materials and workmanship, neither of which can be forthcoming without the wholehearted sympathy and co-operation of the ironfounding trade.

The Cumberland Hotel has one thousand private bathrooms and, in addition, generous public and staff sanitary accommodation has been provided. This experimental system has not been long enough in operation for reliable technical data to be given, but from an authoritative source it is learned that the installation is giving perfect satisfaction, much technical knowledge is being derived, and its adoption to other kinds of buildings, including dwelling-houses, is confidently anticipated.

Development of the System

To Scottish students of sanitary science and to those who have been engaged on work authorised by the Ministry and Scottish Department of Health, the one-pipe system is not really something new, but restrictive legislation has prevented its general adoption on schemes of work in this country. It should be pointed out, however, that existing schemes on the one-pipe principle are comparatively small when compared with the present venture, and while the system was in operation in Scotland over 70 years ago, it was of a primitive nature. This logical development of the dual system always has had a peculiar fascination for Scotsmen, and for a number of years its theory and practice has formed an important item in the curriculum of Sanitary Science at the Royal Technical College, Glasgow. The drainage of the city of Cairo is based on the principle of the one-pipe system, and was designed by an eminent London engineer, but, like many other British scientific advancements, it is to the American Continent we must look for the improvements in its practical application.

In this country it is becoming the general practice for architects to show in their elevations of buildings the points for drainage connections only, and whether from neglect or lack of knowledge, they omit the connections from these points to their junction with the main drain. Plumbers lack the necessary training and requisite information to enable them to set-out such work accurately, and, consequently, this duty has gradually been shifted to the already overburdened shoulders of the ironfounder, who is expected to provide the necessary technical staff, possessed, not only of a knowledge of local building bye-laws, but conversant with the best practices in sanitary science.

The problems of the one-pipe system are somewhat different to anything previously experienced—much greater stresses, for example, are set up in a single stack—and the rule-of-thumb methods presently resorted to in supplying castings cannot longer be relied upon if an efficient one-pipe sanitary system is to be provided. In future due regard will require to be paid to the number of fixtures to be installed; the use to which they will be subjected, and their location in the drainage system. It is only from these data that the sizes of the main and branch lines can be accurately computed.

Choice of Materials

The medium in which the work is to be executed is also of importance. In Britain the main stacks, so far, have been of cast iron, but doubtless, when the necessary legislation to permit the general adoption of the one-pipe system is promoted, a choice of materials will be demanded. In New York the choice is given between cast iron, wrought iron, steel and brass. Cast iron must be fine cast (uncoated), the other metals, except brass, must be galvanised. Lead, except for short branches, inside leaders, bends and traps is prohibited.

For the London experiment the pipes conformed to London County Council specification, so far as this was applicable, and the pipes longer than standard 6 ft. were pro-rata in weight with the standard pipes. In New York the standard length is 5 ft. and the standard weight per linear foot in the various metals (including socket) is:—

In.	Cast iron.		Wrought iron and steel.	Brass.
	Standard.	Extra heavy.		
3	5⅛ lbs.	9½ lbs.	7.54 lbs.	7.92 lbs.
4	7 ,,	13 ,,	10.66 ,,	11.29 ,,
5	9 ,,	17 ,,	14.50 ,,	15.37 ,,
6	11 ,,	21 ,,	18.76 ,,	19.88 ,,

It will be observed that two qualities of cast-iron pipes are specified. The standard pipe may be used above ground in residence buildings not exceeding two storeys and basement in height, but extra heavy pipes must be used for all other work. Main soil stacks must not be larger than 5 in. or smaller than 4 in. The specified fall for all work is not less than ¼ in. per ft. The size, weight and maker's name must appear on each length.

Special Deep-Seal Traps

To withstand the increased stresses of the one-pipe system special deep-seal traps are necessary. At various times traps with a seal of from 6 to 8 in. have been advocated. For the London experiment, however, the traps disconnecting the lavatory basins had a seal of from 3 to 4 in., according to size. These traps were designed on the executant firms anti-"D" trap and were cast in brass. The bath trap, also in brass, was of a design similar to that in use in New York. Few contracts nowadays, however, allow for the provision of all brass traps, and, cast iron being the only alternative medium in most contracts, a range of suitable deep-seal traps will be called for. In New York no form of trap is permitted unless it has been approved by the Superintendent of Buildings after a rigorous test. For anti-syphon traps three samples must be submitted for approval by the Board of Standards and Appeals consisting of:—(*a*) A stock pattern, (*b*) a stock pattern cut in halves and (*c*) a similar trap to (*a*), provided with glass observation ports.

In addition, all the necessary and somewhat elaborate testing apparatus must be provided by the applicant. The traps disconnecting the R.W. stacks from the drain and the drain from the sewer are of the same design. The nearest castings in general use in this country are the one-piece (Scottish) Buchan traps, with an extended socket cast on crown or a socketed hot-water "U" syphon with a socket and spigot inlet and outlet cast on immediately below the main faucets.

The main faucets form the access to the trap, which is provided by means of two cast-iron ferrules caulked in, equal in weight and thickness to the caulking ferrule of the same size of pipe. The access caps (2) must be of brass of not less than ⅛ in. thick, with a solid square or hexagonal nut not less than 1 in. high. The engaging part must be tapered and have not less than six threads of iron-pipe size. The caps must be of full size up to 4 in. dia. From this description it will be seen that in the event of a stoppage the American intercepting or disconnecting trap does not provide the same ready access as does the familiar English patterns. Releasing the screws, too, is something of an engineering proposition. If this design of trap is ever adopted in Britain perhaps those responsible for such matters will agree to forming the two sockets into a single opening with a plate, bridle and screw access similar to that in general use in Scotland and Ireland for gaining access to an inspection chamber. To the modern Scottish student accessibility is not a strong feature of New York design, but, perhaps with flush cisterns of 8 galls. for w.c.'s and 5 galls. for urinals, stoppages are less frequent. Here it is only in the more progressive cities and towns that 3-gall. flush cisterns are permitted, and sometimes with reluctance.

Hand-holes are not provided on the main stacks, and access for rodding is obtained from the end of the branch drain. The end fitting is always a junction, with an access cap in the main faucet. There is a growing opinion amongst sanitary engineers in Britain that the last fitting in a range of lavatory basins or w.c.'s always should be a bend. A waste or soil line extended over the last fitting is more liable to "choke" than is one employing a bend, because match sticks, paper and other light matters have a greater tendency to float up rather than down the drain, and become lodged in the extension when the flush recedes. These light matters accumulate and are the cause of most of the stoppages with which plumbers have to deal. With a bend every part of the line is in contact with the running water when the system is flushed.

In the Cumberland Hotel accessibility is a particularly strong feature of the design. Full hand-holes are provided at all junctions to the main. Perhaps when the one-pipe system becomes general access will be provided from a hand-hole or access pipe immediately above the junction in place of on the junction itself. In the event of a stoppage, with this arrangement the access door can be removed and the cause of the stoppage dislodged without danger of sewage spraying over the operator, walls or street. This arrangement has been adopted by H.M. Office of Works, who also have installed a one-pipe experimental system.

Supporting the Vertical Stacks

Another notable feature of the Cumberland Hotel is the novel method of supporting the vertical stacks. With few exceptions all the R.W., soil and vent pipes have ears cast on, but those supplied to the Cumberland Hotel were uneared. During the building process lugs were built into the concrete floors of the building, and to these twin bars (resembling standard test-bars) were bolted. The pipes were secured to these bars by means of a strap passing over and around the faucet or body and were tightened by nuts behind the bars.

(*Concluded on page* 164.)

Institute of Metals

AUTUMN MEETING IN MANCHESTER

The Annual Autumn Meeting of the Institute of Metals was held at Manchester on September 3 to 6, Dr. Harold Moore, C.B.E. (President) in the chair. On the evening of September 3, Dr. J. L. Haughton delivered the Autumn Lecture on "The Work of Walter Rosenhain" (see Foundry Trade Journal, September 6, 1934). During the remainder of the session various Papers were read. We append summaries of some of these Papers.

The Improvement of White Bearing Metals for Severe Service: Some General Considerations

This Paper, by D. J. Macnaughtan, states that the development in the internal-combustion engine is imposing increasingly severe conditions on the bearings. Consideration is given to the theoretical functions of an ideal white metal, and the manner in which the stresses produced in service tend to cause failure by cracking. Since the normal action of the stresses are compressive, special attention is given to the tension stresses, which are shown to lower the fatigue range of the metal and to open up incipient cracks. Based on this analysis the mechanism of crack formation is discussed. The following directions in which improvement in service behaviour may be secured are considered: (1) diminishing the intensity of the stresses in the metal by modifications in (*a*) certain features of design; (*b*) the material used for the liner; (2) increasing the fatigue-resisting properties of the white bearing metal in respect to which results obtained in preliminary investigations of the fatigue properties of high tin-antimony-copper alloys with and without addition of a further element are given.

Part I, on "Indentation Tests," is by A. S. Kenneford and Hugh O'Neill. There is an appendix on "An X-Ray Examination of Babbitt Metal and of the Age-Hardening of Cast Lead-Alkali Alloy," by G. S. Farnham. The authors state that the effect of viscous flow, ageing, and prolonged heating on the resistance to indentation of tin- and lead-base bearing metals has been investigated. Flow tests with a 120 deg. steel cone at 19 deg. and 96 deg. C. show that Babbitt metal containing 1 per cent. cadmium or 2 per cent. nickel, or a lead-alkali bearing metal, give better indentation results than a plain Babbitt alloy. The hardness of the different metallographic constituents of bearing metals and their softening on heating to 100 deg. C. have been measured by scratch and micro-indentation tests. The matrices lose 40 to 45 per cent., and the cuboids 20 per cent. of their hardness, but the cuboids in a Babbitt remain somewhat harder than those in a lead-base alloy. Two new simple tests are suggested. In the first a lubricated 60 deg. conical casting of the alloy is flattened under 100 kg. load for 30 secs., and the Mallock hardness number determined. By increasing the duration of loading a flow index may be measured on lines similar to "Hargreaves' analysis." Then, by compressing until cracks appear on the extruded edge, the ductility of the specimen and its cracking stress may be measured. At room temperatures the lead-base alloys show relatively low ductility, and this agrees with their low work-hardening capacity as determined by specially-conducted ball tests and repeated impact tests with the scleroscope. The second method employs an instrument similar to the Herbert pendulum, and measures the damping effect. It may not only be used to give rapid indications of hardness at different temperatures, but is also sensitive to the effect of different lubricants.

Part II, on "Tensile Tests," by R. Arrowsmith, states that the tensile properties of white-metal specimens, prepared by gravity die-casting and without any machining, have been determined at room temperature on a Hounsfield "tensometer." Various casting conditions were examined for each alloy. Babbitt metal with additions of cadmium gave the highest values of limit of proportionality and ultimate stress. The greatest ductility was obtained from an alloy No. INC containing 89 per cent. of tin.

Part III, on "Pounding Tests," by H. Greenwood, deals with a modified form of the Stanton impact tester suitable for the testing of white metals by pounding at different temperatures. Various results on cylindrical specimens are given, and the unsuitability of this type of test-piece is shown. The use of bearing-shaped specimens with a cylindrical indenter is described. Results are recorded for eight different white-metal bearing alloys and a lead-alkali alloy, cast under various conditions, and tested at 18 deg., 100 deg., and 150 deg. C. A Babbitt metal with an addition of cadmium gave the greatest resistance to pounding.

Some Properties of Tin Containing Small Amounts of Silver, Iron, Nickel or Copper

Prof. D. Hanson, E. J. Sandford, and H. Stevens, joint authors, state that the tin-rich ends of the silver-tin, nickel-tin, and copper-tin equilibrium diagrams have been investigated. With the first, the eutectic occurs at 3.5 per cent. of silver, at 221.3 deg. C.; with the second at 0.18 per cent. of nickel at a temperature which does not vary appreciably from the melting point of pure tin; with the last, between 0.70 and 0.75 per cent. of copper at 226.9 deg. C. The solid solubility of silver in tin is shown to be approximately 0.02 per cent. at room temperature, increasing to 0.06 per cent. at 210 deg. C. The solid solubility of nickel is less than 0.005 per cent., and that of copper less than 0.01 per cent. at 220 deg. C. The method of making additions to tin is discussed, and it is shown that no particular difficulties are met with in the case of silver, iron, copper, and nickel. The influence of additions of these metals on the tensile strength of tin is discussed. A great increase produced by quenching silver-tin alloys is not permanent at room temperature, whilst with the other three alloys quenching has no effect. Additions of iron above 0.4 per cent. are without effect, although up to this percentage an increase of 40 per cent. in the tensile strength is found.

Nickel up to 0.3 per cent. produces an increase up to 2.1 tons per sq. in., but further additions have no influence. Copper up to 2 per cent. greatly increases the tensile strength after all heat-treatments investigated.

Silver is shown to refine the grain of tin, but not to prevent grain-growth at high temperatures. The addition of iron above 0.05 per cent. or of nickel above 0.06 per cent. prevents such grain-growth, although below these compositions germination takes place. 0.35 per cent. and more of copper prevents recrystallisation of cold-rolled tin at room temperature, but annealing at temperatures from 110 deg. C. upwards produces larger grains than in alloys of slightly lower copper content.

A Reflectivity Method for Measuring the Tarnishing of Highly-Polished Metals

L. Kenworthy and J. M. Waldram describe an apparatus and method for carrying out the quantitative assessment of tarnish on highly-polished metals by reflectivity measurements. The method involves the separate determinations of the specular and diffuse components of reflection, and the use of an empirical formula combining these two properties. The application and validity of the method are illustrated by the results of periodical measurements, and observations made on specimens of pure tin and two tin alloys exposed to indoor and outdoor atmospheres.

The Corrosion of Tin and Its Alloys. Part I.—The Tin-Rich Tin-Antimony-Copper Alloys

T. P. Hoar states that the tin-rich tin-antimony-copper alloys have been examined with regard to their resistance to corrosion by dilute hydrochloric and citric acids and by various tap-waters. The straight 5 per cent. antimony alloy containing no copper is found to be usually somewhat more resistant to these types of corrosion than alloys containing copper. Soft water produces tarnishing; hard water gives no tarnish, but may give localised attack if there is much chalky deposit.

The Influence of Pickling on the Fatigue-Strength of Duralumin

H. Sutton and W. J. Taylor, joint authors, state that in order to assist in the detection of flaws, manufacturing defects, and fatigue cracks in aluminium alloy components, it has been customary to pickle or etch the components in various solutions, the main etching usually being effected in an aqueous solution of caustic soda. Wöhler-type fatigue tests were made on test-pieces machines from duralumin bar, and the effect of various pickling treatments on the fatigue-strength was investigated. Pickling treatment A ($2\frac{1}{2}$ min. in 10 per cent. caustic-soda solution at 60 deg. to 70 deg. C.; rinse; 1 min. in 10 per cent. nitric acid, 10 per cent. sulphuric acid) lowered the fatigue limit by 31 per cent., but the reduction was very much less after immersion of the test-pieces in boiling water. After a layer of 0.0025 in. thick had been machined off, the pickled test-pieces showed normal fatigue properties. Pickling treatment B (2 min. in 10 per cent. hydrofluoric acid, 10 per cent. nitric acid) lowered the fatigue limit by 15 per cent. Pickling treatment C (3 min. in 10 per cent. sulphuric acid 4 parts, hydrofluoric acid 1 part; rinse; 1 min. in 50 per cent. nitric acid) only lowered the fatigue limit by about 6 per cent. and the reduction was less still, *i.e.*, within the limits of experimental error, when the specimens had been immersed in boiling water after being pickled. This treatment appears suitable for pickling new components to reveal macro-structure end defects, or for etching used components for the detection of fatigue cracks, stress-corrosion, cracks, etc.

Some Properties of Heavily Cold-Worked Nickel

H. Quinney states that the Curie point of commercial nickel of 99.62 per cent. purity has been found to be 330 deg. C., which is much lower than that generally accepted for pure nickel. After the metal has been subjected to torsional overstrain the Curie point on heating is raised considerably but returns to its original value on cooling. No such effect is observed with mild steel since the strain is relieved before the metal reaches the relatively-high Curie point.

Experiments in Wire-Drawing. Part IV.—Annealing of H.-C. Copper Wires of Varying Hardness-Elongation Values

W. E. Alkins and W. Cartwright point out that in the preceding Paper of this series the authors gave an account of annealing experiments carried out at varying temperatures for varying lengths of time upon a number of samples of wire, approximately $\frac{1}{10}$ in. in dia., drawn with widely-varying amounts of reduction, from a single heavy wire-bar of very pure h.-c. copper. The breaking load of the wires was the only physical property then dealt with. In response to a generally-expressed desire, the

results of the elongation determinations upon the same wires after the same heat-treatments are now published, though no detailed correlation of the breaking load and elongation data is undertaken. The results again bring out the fact that the more severely-drawn wires become annealed at much lower temperatures than the less hard wires. "Over-annealing," in the sense of a falling-off in percentage elongation values, is apparent when an annealing temperature of 750 deg. or 850 deg. C. is adopted. Maximum elongation values are obtained by annealing for a relatively long time (12 to 24 hrs.) at a comparatively moderate temperature (230 deg. to 280 deg. C.) wires drawn with a reduction of area of the order of 50-75 per cent.

Elongation Values of Copper and Copper-Rich Alloys

MAURICE COOK and EUSTACE C. LARKE state that a study has been made of the effect on elongation values of dimensional variations in test-pieces of copper and copper alloys in strip form. H.C. copper, 70:30 and 64:36 brass, 80:20 cupro-nickel, and 95:5 gilding metal have been investigated, and it has been found that varying the length of parallel portion on 0.5-in. wide test-pieces from 1.5 to 8.5 in. has no appreciable effect on the total elongation values measured on a 1-in. gauge-length. Varying the metal thickness between 0.125 and 0.020 in. does not sensibly affect the elongation, but with metal thinner than 0.02 in. the elongation values decrease with decreasing thickness. With variation in width from 0.25 to 1.5 in. the elongation decreases with decreasing width, the effect being smaller as the gauge-length is increased. Variation in the rate of strain between the limits of 0.06 and 0.55 in. per in. of gauge-length per min. does not appear to affect the elongation values. The effect of gauge-length on elongation values has been considered in detail for the five materials in the soft condition and for 70:30 brass of varying hardness, and a study made of the distribution of elongation along the gauge-length. Values for total and uniform elongation have been obtained and compared with those derived from characteristic formulæ such as those of Unwin, Bach, Bertella, and Krupkowski. The extent of the effect of the local elongation due to necking has been investigated, and its influence in connection with the effect of position of the fracture on the elongation considered.

The "One-Pipe" System of Drainage in Buildings

(*Concluded from page* 162.)

As is becoming the general practice in England the vertical pipes are contained in ducts or shafts. These vertical shafts are continuous from floor level to roof level, with a movable iron grating spanning the shaft at each floor level to act as a working platform. The twin bars of the holderbats, referred to above, also act as bearers for these gratings.

These are the main features in the British and American designs of interest to our trade, and while the method of installation does not greatly concern the ironfounder, it is to him that the architect, sanitary engineer and plumber look for guidance in solving their problems. It is to the ironfounder's advantage, therefore, to prepare himself for this innovation by being conversant with the problems that the one-pipe system creates, and by being in a position to offer such materials as are demanded for the installation of an efficient system.

Messrs. Dent & Hellyer, Limited, Burn Bros. (London), Limited, and Cameron & Roberton, Limited, were the firms concerned with the installation of the experimental "One-Pipe" system of drainage at the Cumberland Hotel.

Iron and Steel Institute

KING LEOPOLD AN HONORARY MEMBER

At the General Meeting of the Iron and Steel Institute, which took place at the Palais des Académies in Brussels last Monday and Tuesday, the announcement was made by the President, Mr. W. R. Lysaght, chairman and managing director of Messrs. John Lysaght, Limited, that His Majesty the King of the Belgians (Leopold III) had honoured the Institute by accepting nomination as Honorary Member. This continues the tradition by which H.M. King Leopold II (1874-1909) and H.M. King Albert I (1913-1934) had been Hororary Members of the Institute.

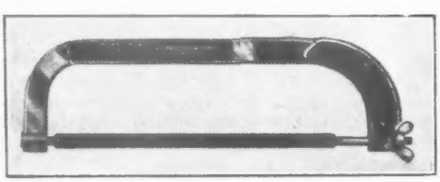
Monsieur Léon Greiner, director and general manager of the Soc. Anon. John Cockerill, Liége, and Monsier Aloyse Meyer, general manager of Arbed, Luxemburg, have been nominated Honorary Vice-Presidents of the Institute. These gentlemen are acting as Presidents of the reception committees, which have been formed in Belgium and Luxemburg to arrange for the entertainment of the members of the Institute now visiting those countries.

It was announced that the Council was proposing Sir Harold Carpenter, F.R.S., for election as President at the Annual Meeting of the Institute in May, 1935, and that they had elected Mr. James Henderson, deputy chairman and general manager of the Appleby Iron Company, Limited, and of the Frodingham Iron & Steel Company, Limited, and President of the British Iron and Steel Federation, to be Honorary Treasurer of the Institute in succession to Sir Harold Carpenter, who is resigning at the end of September.

The date of the Annual Meeting, 1935, was fixed for Wednesday to Friday, May 1 to 3, 1935, and the Annual Dinner is to be on Thursday, May 2, 1935.

"Eclipse" Magazine Hack-Saw Frame

A hack-saw frame so designed as to carry within itself a number of spare blades will be appreciated by most users of such tools. A frame of this type has been designed by Messrs. James Neill & Company (Sheffield), Limited, Composite Steel Works, Sheffield. It is of tabular design, combining exceptional strength with lightness in weight, and utilises the bow to form



"ECLIPSE" MAGAZINE HACK-SAW FRAME.

the magazine. Five spare blades of assorted pitches of teeth are carried in this magazine, so that the correct type of blade is available for every job, whilst upon the handle are instructions enabling the user to select a suitable blade to obtain the most economical results. Stored in this manner, it is impossible for the blade, and particularly the teeth of same, to become damaged by other tools in the kit.

The position and shape of the unbreakable metal handle gives the operator comfortable control with one hand when the frame is used on jobbing work where a vice is not available. Protection for the hand of the operator is ensured by the provision of a long rear tension piece and the use of "Eclipse" flex blades, which are unbreakable in use. Both tension pieces are non-detachable, but allow instantaneous swivelling of the blade for cutting at right-angles.

Oxy-Acetylene Welding at Olympia

The British Oxygen Company, Limited, in conjunction with the Acetylene and Welding Consulting Bureau, took advantage last Thursday of the forthcoming Building Exhibition to give to members of the technical Press a demonstration of the use of oxy-acetylene welding on the structure of British Oxygen Company's stand at the Exhibition. After an informal luncheon at the Clarendon Hotel, Hammersmith Broadway, the party was briefly addressed by Mr. C. Helsby and Mr. Ewart S. Andrews, President of the Institution of Structural Engineers, and then taken by motor coach to Olympia to witness the demonstration.

Mr. Helsby, who is a consulting engineer and a pioneer of oxy-acetylene welding, gave a most interesting address, drawn from his own considerable experience. It was to his welding designs that the all oxy-acetylene welded building was erected last year at Harmondsworth. Later he collaborated with Mr. Ewart S. Andrews in carrying out certain welding designs involved in the construction of a multi-storied building at Stoke Newington. He acted as consulting engineer in collaboration with Mr. Noel Ridley in the recent strengthening, by the introduction of new girders, of Brighton Pier, in which both oxy-acetylene and electric welding were used, and has, still more recently, been appointed consulting engineer for the construction of the new Bexhill Entertainment Hall.

Mr. Ewart S. Andrews, in a short address, discussed the development of the process.

At Olympia the party saw the process of oxy-acetylene welding in operation. The framework of the British Oxygen stand consists of two sections of oxy-acetylene welded steel frame building identical with the welded building at the company's Edmonton works. The roof trusses have been welded at Edmonton, but the various units were assembled and welded at Olympia.

International Relationships and the British Foundry Industry

(*Concluded from page* 161.)

cated free trade throughout the whole world; perhaps one might be excused for believing that some of those present would not live to see it, because, after all, we had to bear in mind racial jealousies. He pleaded that all concerned with the foundry trade in Britain should do everything possible to provide more and constant employment, and under the best conditions; there was nothing so horrible as to see, as we had seen, some of the big firms, employing thousands of men, shutting out a couple of thousand of them at a day's notice. He had heard the managing director of a large motor company say that he would regard it as a disgrace to himself to have to do what had been done in the past by his predecessor, suddenly rendering unemployed a couple of thousand of his employees. When asked how he would plan to prevent that, the managing director had said that "planning" was the right word to use; by scientific planning he could see his way to production for weeks ahead.

The BRANCH-PRESIDENT, responding, said he had never expected, of course, that every member would have accepted all that he had stated; he would be sorry to see Great Britain become a free-trade country again until the rest of the world came into line with us. But his main idea was to give food for thought as to how they would meet that situation, which might quite possibly arise sooner than they expected. There was no question that if we were to sell to the world we must buy from the world.

A Completely Mechanised American Railway Brass Foundry*

By T. W. Lippert

"Push-button" operation well describes a recent trend in foundry practice. As in numerous other industries, the modern non-ferrous and ferrous foundries are being so patterned to speed production, to concentrate equipment in a minimum number of units, and to eliminate so far as possible the manual effort of the workers. Even a partial realisation of such objectives reduces investment costs, cheapens the products without a reduction in quality, and results in a high degree of dependability, economy and efficiency.

A "push-button" objective is becoming increasingly necessary in almost all types of foundries in view of the highly-competitive conditions now prevalent in the industry. To accomplish this end practically all foundries, and particularly non-ferrous plants, are finding it profitable to develop improvements along three major fronts. First, the installation of automatic sand-preparing and handling equipment has been found to effect very large savings in production costs; second, the use of semi-automatic electric-furnace equipment permits a closer approximation of ideal melting conditions, and, third, the use of permanent and continuous moulding apparatus generally results in less metal waste, and the products usually have a more uniformly fine homogeneous microstructure, metallic and non-metallic segregations are reduced considerably, and castings can be more dependably reproduced with full assurance of required metallurgical and mechanical characteristics.

Naturally, all the above desirable attributes are easier to obtain when a foundry is employed in the making of large numbers of similar parts. However, a jobbing foundry making diverse products can effect proportional savings by adopting similar innovations. This generalisation applies to grey-, malleable- or alloy-iron concerns, although the discussion which follows deals particularly with procedures in a non-ferrous foundry as exemplified by the practices at the brass-foundry unit of the Pennsylvania Railroad at South Altoona, Pa.

In this plant mechanisation seems to have reached its peak, as can be seen in the schematic lay-out in Fig. 1. The workers are provided with full facilities to reduce unnecessary motion and physical effort, and the materials handling is completely automatic from the scrap delivered at one end to the other end where finished products are packed for shipment throughout the entire Pennsylvania system. In addition, automatic continuous equipment reclaims, mixes, prepares and distributes the sand, and a battery of nine rocking electric furnaces, practically automatic in operation, furnishes hot metal for almost continuous pouring. Full accessory equipment is used for dust disposal and adequate ventilation.

The products made at the Altoona foundry range into the thousands and include sand-cast tumbler-lock bushings weighing 2 oz., engine bells with their distinctive and familiar tone, as well as large driving box shells weighing 400 lbs. which are made in a permanent moulding machine. However, four types of products account for about 90 per cent. of the output.

The casting of journal bearings (74 Cu, 18 Pb, 6 Sn, and 2 Zn) is one of the major routine tasks of the foundry. These are poured into permanent moulds of the Holley type, and several electric furnaces are devoted to their production. Inasmuch as they are made entirely from scrap materials of low monetary value and the scrap recovery is practically 100 per cent., these journal bearings are produced at a surprisingly low cost.

The second large production item is usually designated as engine brass, and a considerable quantity of phosphor bronze is used for its production. This material (80 Cu, 10 Sn, and 10 Pb) is also made from scrap returned from the railroad shops, although some "doctoring" with phosphorus is necessary to keep this element within specification limitations. This type of engine bearing is poured into sand moulds.

The third substantial product is a form of red brass (85 Cu, 5 Pb, 5 Zn, and 5 Sn) used for casting pressure goods for locomotive construction and repair. These miscellaneous lines of valves and fittings are likewise made from segregated scrap, and they are cast in sand moulds on continuous machines. After machining, each unit is hydrostatically tested at 450 lb. per sq. in., and procedures have been so standardised that very few rejects are necessary.

The final, and probably most interesting, major metal produced in the shop is a high-lead piston packing material, which is melted in two 400-lb. electric furnaces. This metal (60 Pb, 2 Ni, and 38 Cu) is quite difficult to prepare by ordinary means, but it has been found that the rocking motion of the electric furnace produces a thoroughly uniform mixture, and piston packing obtained from this metal is of excellent quality at all times. While some scrap materials of the same composition are used, the bulk of the charge consists of scrap copper and reclaimed lead. Highly leaded bronzes of this type can be cast in permanent moulds, and their excellent wearing qualities have made them very popular with all railroads. They will probably find increasing application in the future, for it is possible to produce from them a harder, stronger and more rigid bearing than those previously used.

Within the past several years the Altoona foundry has striven to reduce to a minimum the number of formulas to be poured. Occasionally when only a few of a certain type of product are to be cast, the foundry uses an expensive metal which is at hand rather than go to the greater expense of melting down a cheaper mixture which would have adequate strength.

Only Domestic Scrap Used

Of course the Altoona plant has a tremendous advantage over a jobbing foundry in that the melting practice revolves entirely about the use of scrap materials which are returned from the railroad system, as is the custom of most railroads. As a consequence less virgin metal must be bought, and scrap segregation is simplified as the original composition of each item is known. Therefore a minimum of analytical supervision is necessary, although the Altoona shop does keep a chemist in constant attendance in order to maintain standard compositions. The scrap material which is received consists of copper, lead, rail bonds, journal bearings, engine brass and miscellaneous brass and bronze fittings. The types of scrap which are received at a certain time usually depend on the reconstruction or repair work the road is doing at a particular time. For instance, large quantities of lead-sheathed cable may be received one month, whereas car and locomotive parts are plentiful the next.

The machinery and practice for classifying and storing the scrap are clearly shown in Fig. 1. Scrap non-ferrous materials from all over the extensive Pennsylvania system are received in box cars, from which they are shovelled into the inclined apron conveyor running up into the foundry building. A magnetic drum inside the building removes all the ferrous contaminations. The scrap falls from the conveyor on to a specially designed sorting platform, which slowly runs in a circular path over a number of storage bins, where two workers classify the products by pushing them off into the proper storage bins. All the unfamiliar metals are well as all yellow brass are segregated and sold to a scrap merchant in preference to remelting in the foundry.

The storage bins open into a small room located about 20 ft. below the sorting platform. In this room the individual charges are made up by a suitable selection of metals from the storage bins. Quite often some virgin metal must be added to assure a required analysis. Each of the charging boxes suspended from a conveyor normally holds sufficient scrap for one furnace heat. An air jack lifts each charging box from the conveyor, after which it is weighed and then again lifted so as to engage a hook of the conveyor.

In Fig. 1 is shown the method by which the charging conveyor inclines upward so as to transport the boxes to the charging floor, which is slightly above the level of the top of the electric furnaces. A particular box is tripped and the contents fall into a hopper trailer, and Fig. 5 shows how the hoppers may be discharged by gravity into the electric furnaces below. After the charging conveyor loops around the electric furnaces, it carries the buckets down until they are again on a level with the bottom of the storage bins. This type of trolley conveyor is not particularly new to industry, but it has come into considerable prominence within the past few years, as it provides flexible transportation in existing plants wherein the installation of a straight line conveyor would be impractical.

The melting equipment in the Altoona plant consists of nine rocking electric furnaces, varying in capacity from 400 lbs. to 3,500 lbs., and one gas-fired furnace for aluminium heats, experimental work, and for heats weighing less than 75 lbs., which are melted in a crucible. Ideal melting conditions can only be obtained, of course, when melting is done in a perfectly neutral atmosphere in which the heat transmitted to the charge per unit time remains constant throughout the melting period. Unfortunately these conditions are seldom attained even with the best of furnaces and supervision. The Altoona foundry as well as many others have found electric furnaces adaptable and dependable. The atmosphere varies between neutral and reducing but close control is possible, and the equipment lends itself readily to semi-automatic operation, whereby the melting and pouring temperatures can always be controlled easily. It is pertinent that the furnace be kept scrupulously clean and free from slag, the lining and patching should be done with strictly neutral material, and the metal charges should be free of sand, oil, carbon insulation, etc.

At the Altoona plant a 3,000-lb. charge can be melted down ready for pouring in about 1 hr., although several of the smaller furnaces are able to deliver 11 to 12 heats in an 8-hr. working period. The total production in one month amounted to 1,972 tons. However, the melting schedules are so regulated as to require a power demand as uniform as possible. As power costs are based on the peak load, every effort is made to keep the furnaces from operating simultaneously. The plant has an inexpensive alarm system which notifies the operators when the peak point is reached; a furnace is usually cut out when the alarm sounds.

The molten metal is brought from the furnace to the pouring stations by a monorail system, as shown in Fig. 1. A unique feature of this monorail is the safety transfer tables which are used instead of spur switches. This device was developed at the Altoona plant, and it consists

D

* Extracted from the "Iron Age."

of a section of rail which operates back and forth from one monorail to another. A ladle of metal suspended on this section can quickly and safely be transferred from one monorail track to another, thereby eliminating the possibility of running a ladle off an open switch.

At the pouring station, the ladle operators stand on a platform which moves in time with the mould conveyor. A novel feature of this lay-out is that the pouring is done at the turn of the mould conveyor. After pouring, the conveyor carries the moulds through the cooling zone to the shakeout position, where the moulds are transferred to an inclined jolt shakeout grating. The sand passes through the grating on to a belt conveyor underneath, while the castings slide off the grating into an apron conveyor which delivers them into large hoppers over the Tumblast mills. From these hoppers the castings about 4,000 castings before replacement is necessary. The chief metallurgical claim for the permanent moulds is their chilling effect. Thanks to this, they produce castings of an exceptionally fine homogeneous microstructure, they are free from metallic segregations or burned-on sand, and for these reasons castings of greater all-round strength and machineability are procured. At the Altoona plant the Holley machine is used almost continuously for the production of journal bearings. Tests have shown that the bearings have a tensile strength about 15 per cent. greater than the equivalent sand cast product.

The cast-iron moulds on the Holley machine are in two parts. One part is stationary, whereas the other opens and closes by an air mechanism. Before the mould is closed for the cast it is smoked and preheated to about 120 deg. ground and overhead equipment. The worth of a reclaiming system is validated by the generally accepted axiom that the average consumption of new sand in steel foundries without such a system is "ton for ton," or one ton of new sand per ton of castings produced. This loss is due to the high temperature of the metal, destroying the bond, breaking up the silica grains, fusing others, etc. Very often steel foundries use 100 per cent. new sand for facing, thereby making it necessary to discard old sand to provide space for the new. Therefore, by reclaiming the old sand and using it with small quantities of new, great savings can be made. And what is applicable to a great extent in steel foundries also finds useful application in non-ferrous foundries.

In the sand reclamation system at Altoona all of the processes are carried out mechanically

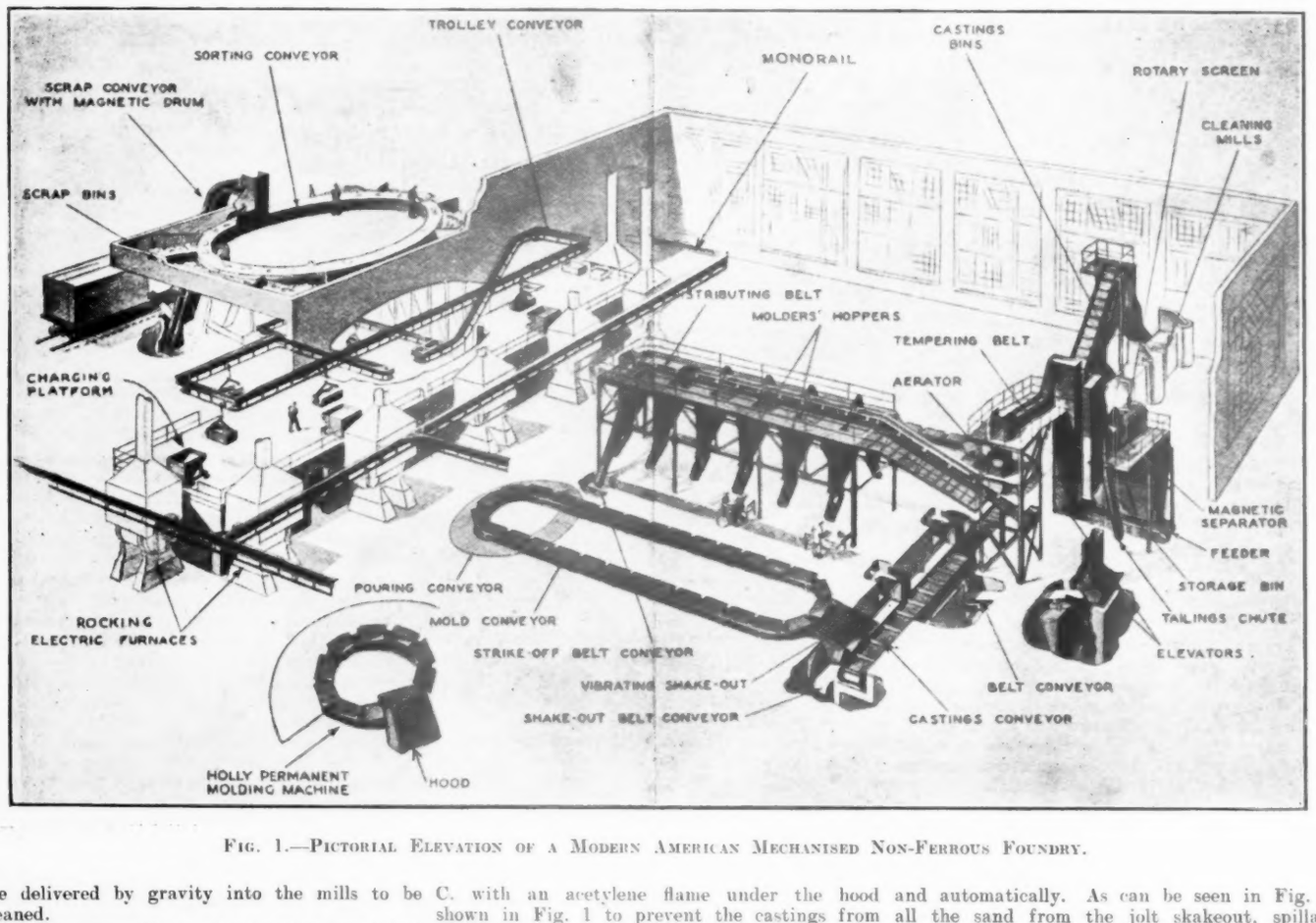


FIG. 1.—PICTORIAL ELEVATION OF A MODERN AMERICAN MECHANISED NON-FERROUS FOUNDRY.

are delivered by gravity into the mills to be cleaned.

All the cores used in this foundry are baked in a gas-fired furnace thermostatically controlled. The small cores and many of the large complicated cores are blown, using aluminium moulds and sharp sand with a little binder. Large cores of simple design are moulded in a conventional manner.

Each moulder transfers a finished flask to the continuous mould conveyor by means of an individual inclined roll conveyor. As each moulder receives tempered sand from an overhead hopper, the back-breaking labours of sand shovelling and flask lifting are eliminated. A large variety of sand castings, varying in weight from 2 ozs. to 150 lbs., are made in the manner described above. However, permanent moulding machines are used for several products, including piston-rod packing weighing 5 lbs. to driving box shells which weigh 400 lbs.

A Holley permanent moulding machine is shown in Fig. 1, and its operation is familiar to many. In general, each mould is good for C. with an acetylene flame under the hood shown in Fig. 1 to prevent the castings from sticking. A light fire clay wash is applied several times daily to minimise fire cracks or spider webbing of the moulds. Other operators have found such a silica wash desirable for low temperature pouring, but for higher temperatures they usually prefer a mixture of paraffin, lubricating oil, and a small amount of plumbago, which is sprayed on the mould prior to pouring. In pouring on the Holley machine, care is taken to start with a large and rapid stream of metal, slowing down gradually as the mould fills. This procedure reduces shrinkage and waste loss due to large risers. Care is also taken to pour at a temperature about 40 to 55 deg. above the temperature required for an equivalent product in a sand mould.

Automatic Sand Equipment

The sand handling installation at the Altoona foundry is graphically shown in Fig. 1. Floor space is saved and a much neater plant appearance results from the use of this type of under- and automatically. As can be seen in Fig. 1, all the sand from the jolt skakeout, spillage and strike-off sand in the moulding bay falls through gratings on to moving belts. These belts deliver the sand to an elevator, at the top of which it passes over a magnetic separator, which removes nails, gaggers and all particles of ferrous material from the sand. The sand is next delivered to a rotary screen through which it passes into a storage bin underneath. From the bottom of this bin the sand is fed into an elevator, which delivers it on to a tempering belt where the proper moisture is added.

The tempering belt delivers the sand to an aerator, in which the sand is thrown at high velocity through a series of wire brushes, which breaks up all small lumps present and thoroughly mixes the materials. The light and fluffy sand from the aerator falls on a flight conveyor, from which individually operated plough controls direct the sand back into the various moulders' hoppers. This mechanical system of control assures a constant supply of uniformly conditioned sand, and

(*Concluded on page* 168.)

The Ecclesfield Works of Hall & Pickles, Limited

HIGH-FREQUENCY FURNACE INSTALLATION

When Hall & Pickles determined to extend the scope of their activities in the manufacture of high-grade steels, it became necessary to find a suitable site for the works, as all the available space in the vicinity of their Bessemer Road works was fully taken up. Obviously, the selection of the site called for the consideration of several factors. In the first place, as it was determined to adopt the high-frequency electric-melting process, the availability of power was a vital factor, but it was also necessary to select a site affording good transport facilities. Ecclesfield is the direction in which industrial Sheffield is rapidly extending, and it is served by both the L.M. & S. and L. & N.E. Railways. Electricity is available from the Yorkshire Electric Power Company, and as it is in close proximity to collieries and coke works, the situation is ideal from the manufacturing point of view.

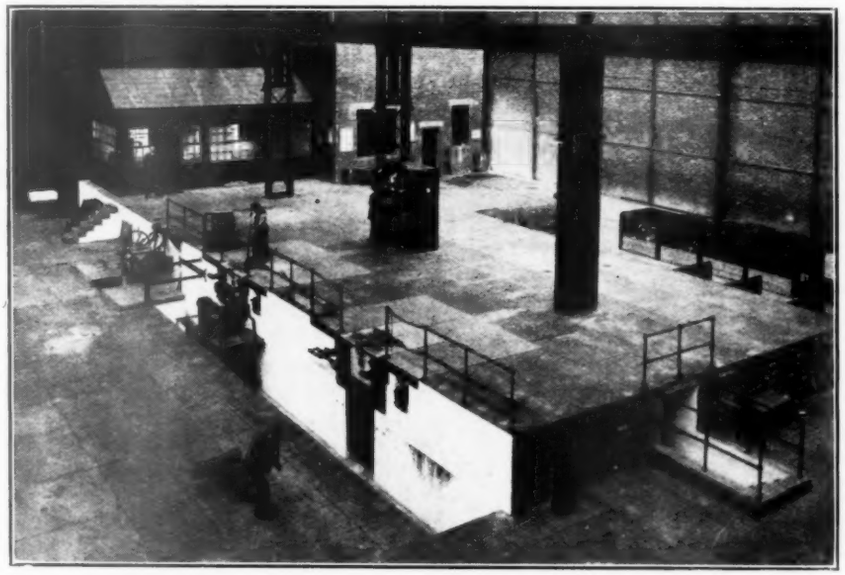


FIG. 1.—VIEW SHOWING LAY-OUT OF ELECTRIC FURNACE DEPARTMENT.

The site chosen for the works under notice adjoins the main road from Barnsley to Sheffield, and the company purchased some 50 acres of freehold land in order to make adequate provision for their future requirements. In the meantime it was not proposed to do other than erect and equip the steel-melting shops, though at a later date it may be determined to centralise the whole of the company's activities in one works, which will be built on the Ecclesfield site. For the present the Ecclesfield works are devoted solely to the production of steels of the high-speed type, low-alloy tool steel, hot- and cold-die steels, a complete range of heat-resisting steels, stainless steels, special alloys of the nichrome type for electric heaters, straight-chrome, nickel-chrome types, etc.

In order to take advantage of the most advanced modern practice in the selection of plant and the general lay-out of the works, Messrs. Campbell & Gifford were called in as consultants, and the present works were designed by them and erected under their supervision. In the lay-out they provided for the larger scheme, which will ultimately be undertaken. The works are approached by a broad road of ferro-concrete construction, reinforced with B.R.C. fabric, and on this road is installed a Ross 30-ton weighbridge for dealing with the roadborne traffic. The works are housed in a building 120 ft. long by 100 ft. wide, but, having been erected with a view to future extensions, three of the walls are of a temporary nature, the fourth wall, which forms a permanent member, is steel-framed and brick-filled. The shop is divided into two main bays, one of which is laid out for the storage of raw materials; this bay is traversed by a double line of standard track. Bins are provided for the storage of material on either side of the track and the bay is served by a 2-ton overhead crane, a rather unusual feature of which is the provision of hand control from ground level in addition to the usual cabin control. Stocks of the more expensive metals and alloys are carried in a strongroom.

The furnace bay is served by a 5-ton overhead crane. The melting plant comprises an Ajax-Northrup high-frequency coreless induction furnace, which is provided with two bodies of 7 cwts. and 12 cwts. respectively. The possibility of such an arrangement is one of the many outstanding advantages of the high-frequency melting furnace; two or more bodies of different sizes can be operated alternatively with the same electrical equipment.

In addition to the furnace referred to, there is a small furnace of the same type in which melts of from 50 to 200 lbs. are made; this furnace is mainly used for experimental work or to meet small special orders. The furnace tops are level with the floor of the charging platform. The charging door is a hole in the charging platform, and so the charging and the inspection of the charge during melting and working are considerably simplified. Further, the whole body of the furnace is well out of the way, and the tilting mechanism, being entirely covered in, is free from interference.

The furnace consists of a body containing a helical water-cooled copper coil, through which the high-frequency current is passed. Inside the coil is the lining, made by surrounding a steel template by a dry granular refractory material, either acid or basic as the case may be. The template, of the shape of the hearth which it is desired to form, is heated by induction from the furnace coil, and by the time it is melted the refractory material is fritted to a sufficient depth, the molten template forming part of the first charge. The average life of the lining in the furnace under notice is 70 heats.

The charge is delivered to the furnace in square drop-sided boxes, which may be tipped direct into the furnace by the shop crane or discharged on to the furnace platform to be raked into the furnace as desired. The only structure on the furnace platform is the control board. Owing to the fact that the control scheme is practically automatic in action, the operator, relieved of electrical responsibility, can confine himself to the metallurgical work.

The condensers, which form an important part of the equipment, together with the pumps, are placed below the furnace level. Switches are provided to vary the number of condensers in circuit to maintain a high power factor under the varying electrical conditions, which enable the full output of the generator to be taken at all stages of the heat.

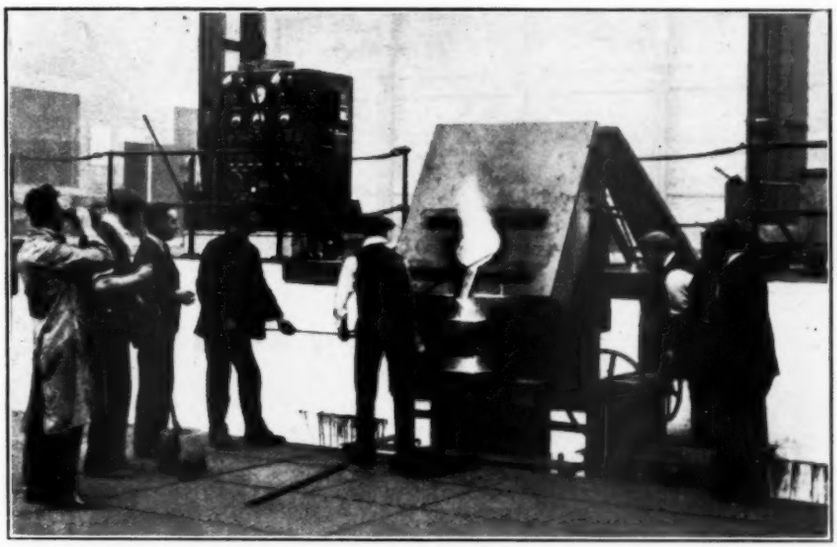


FIG. 2.—CASTING NO. 1 INDUCTION FURNACE.

Provision is made for casting direct from the furnace into the ingot moulds carried on bogies travelling the pit at right angles to the furnace spout. When tilting, the furnace body rests rigidly on auxiliary trunnions, an arrangement which ensures a steady stream of metal. The

cast is made through a tundish which is positioned over the mould and splashing troubles are eliminated; the tundish also helps materially to steady the stream, whilst incorporated in its design is a skimmer for the removal of slag and so ensure quiet pouring. The practice of casting by means of ladles is, however, more generally in use.

The motor-generator set is housed in a separate building distant some 60 yds. from the melting shop and adjacent to the sub-station of the power company. The power unit supplied by the English Electric Company, Limited, comprises a motor generator of 400 k.w., 1,000 volts, 1,000 cycles, the motor taking current at the incoming voltage of 11,000. In the sub-station there is also a transformer stepping down to 400 volts for general power purposes. All work of analysis in connection with the Ecclesfield works is carried out in the company's central laboratory at the Bessemer Road works. A small laboratory has, however, been erected at one end of the furnace platform for the checking and control of the furnace charges. The works as a whole are remarkably well laid out for orderly and economic production, and there is that scrupulous cleanliness which in a melting shop is only possible with high-frequency furnaces as the melting units. The process is, of course, the cleanest ever known, and those employed work under as nearly as possible ideal conditions.

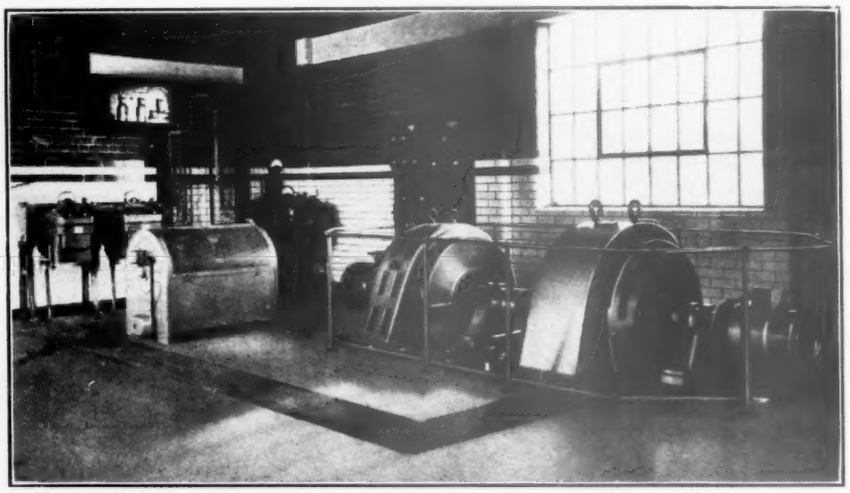


FIG. 3.—VIEW SHOWING MOTOR GENERATOR SET.

Catalogue Received

Pins and Bushes. A folder received from Edgar Allen & Company, Limited, of Imperial Steel Works, Sheffield, is devoted to a description of a line of manganese-steel bushes and pins. Two photomicrographs are shown, but much of their value is lost because no magnifications are given. The pins, which are illustrated by an outsize picture, appear particularly suited for use with moulding-box parts except that the slots would be in general of about double the length. It would be interesting to learn whether manganese steel has been used for this purpose. The bushes illustrated are just on the large size for most moulding boxes, but no doubt smaller castings could be made.

Cutlers' Company

Mr. Alexander Williamson, Senior Warden of the Cutlers' Company, Sheffield, was last week elected Master Cutler, in succession to Mr. C. J. Walsh. He will be installed on October 2, and the Cutlers' Feast will be held on October 18. Sir Samuel Roberts, Bt., M.P., was elected Senior Warden, and Lieut.-Colonel W. Tozer, Junior Warden.

Queueing Up for Lead

BY "ONLOOKER."

In common with copper and spelter, the course of lead prices has recently been downwards, and in the early part of September the spot quotation in London declined below £10 10s. It is, of course, true that only on a few scattered market days during the present year has the forward lead quotation managed to struggle up above £12, but, nevertheless, the decline has been quite a sharp one, and the ruling price compares very unfavourably with the figure of £14 obtaining not much more than twelve months ago. In pre-war days lead was quoted nearer £20 than £10, and one imagines that the producers would be only too glad to see those days back again.

Statistically, the position of lead is not too sound, for production has been on a very heavy scale for some time past, and there are no indications of any slowing down of activity in the near future. Indeed, it is difficult to see how there can be much falling off in this respect, for lead is largely a by-product being mined in conjunction with silver in various parts of the world. A certain amount of control over output is exercised by individual interests, but there is no sort of cartel as exists in spelter, and the matter is very much one of "go as you please." Demand is good, in this country exceptionally so, and the metal is passing very freely into consumption, orders from the cablemakers having improved quite considerably during the past few months, but it is a matter for regret that Germany has practically withdrawn as a buyer on the world market. On the whole, however, there is a well-maintained and widespread interest in lead, which must always continue to be a metal well to the front in the engineering and manufacturing sections of industry.

It is at first sight not easy to say why in face of conditions the reverse of bad as far as usage is concerned, the price of lead in London should have sunk so low, but the answer is found in the fact that arrivals of foreign lead, unable to find an outlet through normal channels of consumption in this country owing to the tax of 10 per cent., are being sold on the metal exchange and the metal put into bonded warehouses at the ports of entry. Empire lead, on the other hand, coming in free under the tariff arrangements, is quickly snapped up by consumers, and there is now very little of this available for prompt delivery, such reserves as were lying in store having been taken up. The position has indeed been growing worse for months, and is now beginning to assume the aspect of a famine, for, in order to make sure of supplies, manufacturers are being compelled to book their lead a long way ahead, and trust that the somewhat indefinite arrival dates will fit in with their programme of production.

Inevitably, this shortage has led to the charging of premiums over the metal exchange price, and in consequence there is much dissatisfaction amongst consumers already harassed by having to await their turn in order to secure supplies of a much-needed raw material. It is safe to say that those trades interested in the use of lead, for which we have for many years now been dependent upon imports from overseas, were never in favour of making this commodity subject to duty, but had they visualised early in 1932, when this tax was first imposed, circumstances such as exist to-day, their opposition would have been very much more determined than it was. The trade was, of course, assured that ample supplies of Empire lead would be available, but this is not now the case.

A Completely Mechanised American Railway Brass Foundry

(*Concluded from page* 166.)

as a consequence there is a low loss value due to holes, drops and blows in the moulds and castings. At the Altoona plant, the same sand is used for the various metals poured, it has a composition approximately the same as No. 2 A.F.A.

The practices at the Altoona plant which have been described well illustrate the full extent to which foundry mechanisation can be carried. As a concluding but quite important observation it can be noted in Fig. 1 that the pouring stations are in close proximity to the electric furnaces. This is an important consideration, as practically all non-ferrous metals and alloys have narrow ranges of pouring temperatures which result in products with optimum characteristics. These temperature ranges are usually 35 to 40 deg. C. and, as a ladle of metal can drop 50 deg. C. in a surprisingly short time, it is of paramount importance that metal delivery and the pouring operation be as rapid as possible. Any attempt to compensate for this loss by raising the temperature in the furnace usually results in some "burning," and the metal usually suffers more from this punishment than from cold pouring. It is generally conceded that 1,175 deg. C. is the best temperature at which to pour an alloy such as 78 Cu, 16 Pb, 4 Sn, and 2 Zn, and 1,045 deg. C. is judged best for locomotive bearings with about an 80-10-10 composition. A red brass analysing 85 Cu, 5 Sn, 5 Zn, and 5 Pb should be poured in sand moulds at a temperature slightly below 1,205 deg. C. For this material a sulphur content up to 0.10 per cent. improves the flowing properties and does not adversely influence the product if the temperature is kept below 1,205 deg. The Altoona foundry uses an immersion pyrometer in each ladle in order to have complete knowledge of the temperature at all times during pouring.

50,000-kw., 33,000-volt Turbo-Alternator

The West Midlands Joint Electricity Authority has just placed an order with the British Thomson-Houston Company, Limited, Rugby, for a 50,000-kw. turbo-alternator. This machine is generally a duplicate of that already installed by the B.T.H. Company in this generating station, except that the alternator of the new machine is wound for 33,000 volts, whereas the existing alternator is wound for 11,000 volts, the generated current being transformed up to 33,000 volts by means of single-phase transformers. This 33,000-volt alternator is the largest ever ordered for this voltage. The turbine is of the two-cylinder double-flow type designed for a steam pressure at the stop valve of 375 lbs. per sq. in. gauge, 750 deg. Fah. total temperature. The condensing plant will be manufactured by Messrs. Hick, Hargreaves & Company, Limited, Bolton.

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This Week's News in Brief

Trade Talk

SIR THOMAS WILFORD, K.C.M.G., late High Commissioner for New Zealand and a director of the National Bank of New Zealand, has joined the board of Sternol, Limited.

AT A RECENT MEETING of the Falkirk Dean of Guild Court an application for the erection of additional warehouses and buildings by the Grahamston Iron Company, Limited, was granted.

AMONG CONTRACTS secured recently by Messrs. Peter Brotherhood, Limited, of Peterborough, is one for air compressors for the giant Cunarder, No. 534, from Messrs. John Brown & Company, Limited.

THE EX-WHITE STAR LINER, "Albertic," sailed from Glasgow for Japan, where she is to be broken up for scrap. Another liner to share the same fate is the "Trojan Star," which has been purchased by an Italian firm of shipbreakers after three years of idleness in Rothesay Bay. She will carry 6,000 tons of coal to Italy.

WORKERS IN THE brass department of Messrs. Shanks & Company, Limited, Tubal Works, at Barrhead, have received intimation that the wage reduction of 5 per cent. which was made last winter is to be restored as from September 12. The decision affects about 130 men and women whose basic rate of wages was reduced.

THE EGYPTIAN STATE RAILWAYS administration, Indian State Railways and the Government of Mysore Railways have placed contracts with a number of British firms, including Messrs. R. Y. Pickering & Company, Limited, Wishaw. Messrs. Pickering have also received an order for 10 bogie rail tank wagons from Imperial Chemical Industries, Limited, for use on British railways.

SIR WILLIAM ARROL & COMPANY, LIMITED, Glasgow, and Messrs. Redpath, Brown & Company, Limited, Edinburgh, are to supply all the steel structural work for the new Guiness brewery to be built at Park Royal, London. The contracts have been placed by a firm of engineers on behalf of Messrs. Arthur Guiness, Son & Company, Limited, Dublin, and will include many hundred tons of steel sections and plates.

STATED TO BE the first double-blast bellows made, and winners of first prizes at three consecutive shows in 1859, 1860 and 1861, this part of a blacksmith's plant has been in continuous daily use at the old country forge of Mr. W. Deacon, at Paynter's Cross, Cornwall, until some three months ago. They were purchased by the present proprietor's father, and have been in use ever since at the smithy, at which four men used to be employed for about ten hours a day.

THE NEW TRADES SCHOOL in Garnethill, Glasgow, built by the Corporation of Glasgow for over £150,000, will be officially opened on September 26 by Sir Godfrey Collins, Secretary of State for Scotland. The school provides instruction in 23 trades, including patternmaking and foundry practice and science. An advisory committee of the Scottish Branch of the Institute of British Foundrymen has co-operated with the Education Committee of the Corporation in the designing and equipping of the patternshop and foundry. The instructors in these classes are all members of the Institute, Scottish Branch.

THE TRADE IMPROVEMENT in Glasgow and the West of Scotland is reflected in the figures of the past year's working of the Clyde Trust. Revenue rose to £796,935 from £733,721 in the previous year. There was a substantial surplus on the year's working against a deficit the previous year. There was an increase of 799,387 tons of goods imported and exported. Amongst the increases in inward traffic were iron ore, 176,749 tons; bar iron, pig-iron and steel billets, 56,718 tons; limestone, 34,036 tons. Among the exports, increases were iron and steel, 77,306 tons; and machinery, 16,976 tons. Trade with Western European ports have not shared in the improvement to any appreciable extent.

GLENBOIG, THE CENTRE of Scotland's firebrick-making industry, is at present enjoying a mild trade boom. The works of Messrs. P. & M. Hurll at Gartkiston are working at full capacity to cope with orders from Belgium, France and Canada. All the employees of the firm who were suspended when the works were slack have been re-engaged, and work is being carried on seven days per week and nearly every night. A large order from the Dominion Iron & Steel Corporation is mainly responsible for the rush, as the order must be completed before the St. Lawrence closes to navigation. The Glenboig Union Fireclay Company's Star Works are also busy, and the old works of the company, which have been closed for almost two years, are partially reopened.

THE EXECUTIVE and chiefs of departments of the Fraserburgh Pneumatic Toolworks entertained two managers of the Consolidated Company from abroad at dinner in the Station Hotel, Aberdeen. The guests were Messrs. A. G. Slatcher, of Detroit, U.S.A., and H. C. Swift, the South African manager. Mr. J. M. Vass, the manager of the Fraserburgh works, who presided, said, in proposing the health of Mr. Slatcher, that their company was an international one, and Mr. Slatcher had come over to Europe to see the needs of the respective countries. He had been in Germany, Scandinavia and South Africa, and he was returning to America with a fund of information, which he felt sure would be used to good purpose. It had been a pleasure to work with him during the months which he had spent at Fraserburgh. He presented him with a crystal decanter as a token of the regard of the works staff. The health of Mr. Swift was proposed by Mr. Burnett, who said that no man had worked harder than Mr. Swift for their product.

Contracts Open

Brazil, October 10.—Cast-steel buffer-guides for railway carriages, for the Viacao Ferrea do Rio Grande do Sul. The Department of Overseas Trade. (Reference G.Y. 14,219.)

London, September 18.—Twenty-ton motor wagon weighbridge, for the Tottenham Urban District Council. Mr. H. F. Wilkinson, engineer, Town Hall, Tottenham, N.15. (Fee 10s., returnable.)

Hemel Hempstead, September 17.—Electrically-driven bore-hole pump, for the Hemel Hempstead Rural District Council. Messrs. Howard Humphreys & Sons, 17, Victoria Street, Westminster. (Fee £1 1s., returnable.)

Straits Settlements, November 5.—Galvanised wrought-iron unsocketed tubes and malleable iron pipe fittings, for the Singapore Municipal Water Department. The Department of Overseas Trade. (References G.Y. 14,235 and G.Y. 14,236.)

Company Reports

Brown Bros., Limited.—Interim dividend on the ordinary shares of 2½ per cent., less tax.

R. & W. Hawthorn Leslie & Company, Limited.—Revenue balance, after debiting depreciation and including income from investments, £23,797; net profit, after debenture interest and other charges, £16,157; brought in, £9,914; dividend of 4½ per cent., less tax; carried forward, £9,949.

United Steel Companies, Limited.—The directors announce that the profit for the year ended June 30, after charging directors' fees, interest on loans, and income tax, but before providing for depreciation, is £947,680. A dividend of 5½ per cent., less tax, will be recommended at the annual general meeting which will be held on October 4.

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Savestane Steel Company, Limited.—Capital £100. Manufacturers of and dealers in stainless steel. Subscriber: J. K. Rocker, Travellers' Club, Pall Mall, London, S.W.1.

B.I.A. (Patents), Limited, 145, St. Vincent Street, Glasgow.—Capital £100 in 2,000 shares of 1s. each. To take out and acquire patents and patent rights. Subscribers: William Rennie, ironfounder, Keppoch Ironworks, Glasgow, and Daniel Sharpe, ironfounder, 65, St. Andrews Drive, Glasgow, S.1.

Will

GRAY, WALTER GIBB, managing director of the Steel Company of Scotland, Limited £51,892

Personal

MR. G. C. PIERCE, of Elliott Bros. (London), Limited, Past-President of the London Branch of the Institute of British Foundrymen, has changed his home address from Bellingham to 296, Northumberland Avenue, Welling, Kent.

MR. NORMAN M. HUNTER, general manager of the Wallsend shipyard of Messrs. Swan, Hunter & Wigham Richardson, Limited, has been awarded the Shipbuilding Gold Medal of the North-East Coast Institution of Engineers and Shipbuilders for his Paper on "The Electric-Welded Ship, 'Peter G. Campbell.'"

MR. JOHN WARD, who for some years has been manager of Messrs. Hardie & Gordon, Limited, Levenbank Foundry, Dalreoch, near Dumbarton, resigned recently. Mr. George Longden has been appointed foundry manager and takes up the duties on September 10. Mr. Longden has for some time been assisting his brother, Mr. E. Longden, at Messrs. Craven Bros., Limited, Manchester.

MR. ALEXANDER WILLIAMSON, the new Master Cutler, is general manager of the Steel, Peech & Tozer and United Strip & Bar Mills branches of the United Steel Companies, Limited, Sheffield. He is a member of the Institution of Civil Engineers and the Institution of Engineers and Shipbuilders in Scotland. He was born in the Isle of Bute and educated at the Greenock Collegiate School, taking his degree of Bachelor of Science in Engineering at Glasgow University, in 1902, at the age of 21. He joined Messrs. Scott's Engineering & Shipbuilding Company at Greenock, and later was for some time with the Parsons Marine Steam Turbine Company, Wallsend, going from there to Sheffield 27 years ago to take up a position in the drop-forging department of Vickers, Limited, at the River Don Works, eventually becoming deputy to the late Sir George Buckham, whom he succeeded in the control of the Sheffield works of that firm. In 1932, Mr. Williamson retired from the board of the English Steel Corporation, and then became associated with the United Steel Companies, Limited.

Obituary

THE DEATH OCCURRED, in the Falkirk Infirmary, on September 1, of Mr. William Watson. Mr. Watson, who was in his 83rd year, was for 48 years in the employment of the Falkirk Iron Company, Limited, Falkirk, as a coremaker. Forty or fifty years ago he contributed to the "Falkirk Herald" poems on the subject of the Falkirk foundry trip, which was at that time an important annual event in Falkirk district.

MR. JOHN T. MOULD, director of the Igranic Electric Company, Limited, died last Thursday at the age of 73. He received his early training with the Lancashire and Yorkshire Railway Company and later joined the electrical department of the Sturtevant Engineering Company, Limited, to develop the sale of electric motors and control apparatus. In 1905 the Adams Manufacturing Company, Limited, was formed, and he was appointed sales engineer, and later, in 1913, when the Igranic Electric Company, Limited, took over this concern, Mr. Mould acted as sales manager, and continued in that capacity until last year, when he was appointed a director of the company.

Economic Situation of Ship Salvage

More than 170,000 tons of sunken German warships still lie in Scapa Flow. A quarter of a million tons have already been salved, and so costly has the work been in comparison with the return for scrap material that speculation is revived on whether operations will be suspended. Among the ships still to be brought up is the dreadnought "Grosser Karfurst," built at enormous cost but put out of action before it had time to "spit fire." The raising of the "Bayern" recently reduced the number left in the Flow to 12—nine battleships and three cruisers. It took eight months to refloat "Bayern," and a survey of the others shows that a number will be even more difficult to salve. Much depends on the price of scrap. On top of the expense of bringing a ship to the surface there is the cost of towing it to Rosyth to be broken up. Metal prices vary considerably, and there is no guarantee that the present improvement will last. That is why it is difficult to say whether salvage will be continued without a break until every ship is raised.

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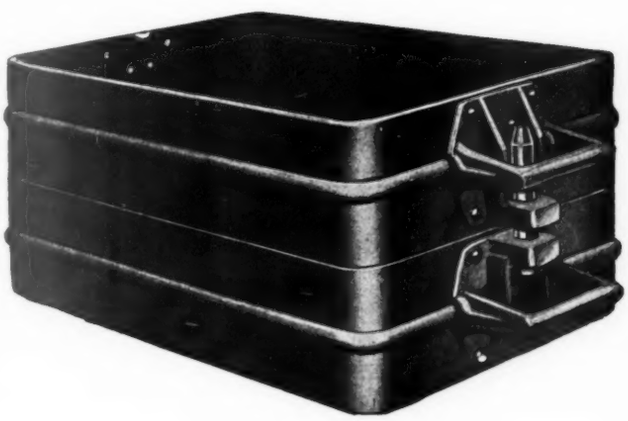

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XUM

Raw Material Markets

Activity in the iron and steel markets is gradually quickening. The demand for pig-iron has increased, and forward buying has been more active. A number of consumers have entered into contracts running into the first quarter of 1935. Present indications point to a satisfactory measure of employment in the foundry industry during the coming winter.

Pig-Iron

MIDDLESBROUGH.—So far, forward buying of Cleveland foundry iron has been slow to expand, many consumers continuing their policy of short-period purchasing, this being the outcome of the recent period of stable prices. The current output is fully accounted for by the heavy local consumption, the strong demand from Scotland and the improved call from overseas. To home users prices are unchanged, the standard foundry grade, No. 3 Cleveland G.M.B., being quoted at 67s. 6d. delivered Middlesbrough, 69s. 6d. delivered North-East Coast, 67s. 3d. delivered Falkirk, and 70s. 3d. delivered Glasgow. For other grades there are the usual variations, namely, 2s. 6d. extra for No. 1 foundry iron and 1s. discount for No. 4 foundry and No. 4 forge.

The demand for hematite is reported to have slackened off slightly as compared with recent weeks, but East Coast producers continue to get the lion's share of the business, by virtue of the price advantage they hold over ironmasters on the West Coast. A few export orders have been secured, at prices understood to be in the region of 61s. per ton. This compares with a home minimum of 68s. per ton for No. 1 East Coast hematite, delivered Middlesbrough, 70s. delivered Durham and Northumberland, 75s. delivered Scotland, 76s. delivered Lancashire, and 79s. delivered Birmingham.

LANCASHIRE.—With the ending of holidays in various areas, there has been an automatic increase in pig-iron consumption, but beyond this there has so far been no expansion. The price position remains steady, with offers of Staffordshire, Derbyshire, Lancashire and Cleveland brands of No. 3 foundry iron quoted for delivery to users in the Lancashire zone on the basis of 74s. per ton, Northamptonshire at 72s. 6d., Derbyshire forge iron at 69s. to approved users, Scottish foundry at about 82s. 6d., West Coast hematite at around 80s. 6d., and East Coast at 76s. for No. 1 and 75s. for No. 3, both unbroken.

MIDLANDS.—Trading has been considerably more active in this area during the past week. A number of foundries have bought ahead as far as the end of the year—in some cases over the first quarter of 1935. There is little possibility of any alteration in values. The present controlled levels, including delivery to Birmingham and Black Country stations, are 67s. 6d. per ton for Northants No. 3 and 71s. for Derbyshire, Lincolnshire and North Staffordshire No. 3. There is, too, a definite improvement in the demand for pig-iron from the general engineering section. This class of trade calls for both common and the better grades of iron. The latter vary considerably in price, the figure depending on the source of the iron and also on the analysis specified. Medium-phosphorus pig-irons are offered at from 72s. 6d. to 80s., while Scottish and other low-phosphorus irons are quoted at between 85s. and 87s. 6d. per ton. There is also an improved and slowly-expanding demand for special refined pig-irons. These quotations also vary, ranging for delivery locally between £5 10s. and £6 15s. per ton.

SCOTLAND.—The demand for Scottish foundry iron shows no improvement, hand-to-mouth buying remaining the general rule. There is no change in the price of No. 3 foundry at 70s. f.o.t. furnaces, with 2s. 6d. extra for No. 1. Quotations for shipment are :—No. 1, 71s.; No. 3, 68s. 6d., f.a.s. Glasgow. A good trade continues to be done in English iron, consumers of which are looking forward to a busy winter. There is no change in the official prices for Cleveland iron, *viz.*, 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow for No. 3 foundry.

Coke

The foundry-coke market remains steady, a large number of consumers having contracted forward for three or six months at the present rates. Quotations for delivery in the Birmingham area remain as follow :—Best Durham coke, 36s. to 40s.; Scottish, 40s. to 41s.; Welsh coke, 37s. 6d. to 45s. per ton.

Steel

Business is gradually expanding, and a more optimistic tone is noticeable in the market than for a number of weeks, states the official report of the London Iron and Steel Exchange. In the semi-finished steel department, business has become more active after a lull in the demand. The production is on a heavy scale, and most of the works are well provided with orders. Continental competition has been less noticeable, but a certain amount of business has been placed with foreign works by home consumers. The demand for finished steel, although it is principally on home account, is sufficient to keep the works busy, and lately an increased business has been transacted. The export markets are showing fair activity, but transactions, except in a few special cases, are limited to small orders.

Scrap

Reports from the scrap-iron centres generally indicate that the demand from foundries continues to broaden out slightly. In the Cleveland area, merchants are asking 50s. for heavy cast iron, 52s. 6d. for machinery metal and about 41s. for light metal. The market remains firm in the Midlands, prices having been unchanged for a long time. In Scotland, good, clean machinery cast-iron scrap is around 53s. 6d. to 55s., with ordinary cast iron to the same specification at 52s. In South Wales, business remains poor, and there is only a limited demand for good cast-iron machinery scrap at 50s. to 52s. 6d., with heavy cast iron at 47s. 6d. to 48s. 6d. and light metal at 40s. to 42s.

Metals

Copper.—Business in copper on the London market has been distinctly slack during the past week, and prices have weakened correspondingly. While copper manufacturers in this country remain comparatively busy, they have evinced little desire to buy at the present juncture. The Continental demand has been limited, whilst the situation in the United States is overshadowed by the strike in the textile industry, which, it is feared, may spread to other trades if an early settlement is not reached.

Daily market prices :—

Cash.—Thursday, £28 to £28 1s. 3d.; Friday, £27 16s. 3d. to £27 17s. 6d.; Monday, £27 7s. 6d. to £27 8s. 9d.; Tuesday, £27 6s. 3d. to £27 7s. 6d.; Wednesday, £27 8s. 9d. to £27 10s.

Three Months.—Thursday, £28 7s. 6d. to £28 8s. 9d.; Friday, £28 2s. 6d. to £28 3s. 9d.; Monday, £27 12s. 6d. to £27 15s.; Tuesday, £27 12s. 6d. to £27 13s. 9d.; Wednesday, £27 15s. to £27 16s. 3d.

Tin.—The price of this metal has shown a fluctuating tendency recently. This is not considered due to any activity on the part of industrial buyers, however, but rather to the control exercised by certain "pools." Abroad, there has only been a quiet industrial demand, both as regards Europe and the United States, but tin consumers in this country have transacted a fair amount of buying.

Messrs. Rudolf Wolff report that "in the United States of America a good deal of uncertainty still prevails, and less activity is experienced, sentiment there being rather disturbed by the strike in the textile industry and the possibility of the labour troubles spreading in other directions. . . . The outlook remains uncertain, and fluctuations, therefore, are likely to be confined within narrow limits; there is, however, no evidence of essential weakness, and decline in price of any importance is scarcely to be anticipated."

Price fluctuations :—

Cash.—Thursday, £229 5s. to £229 7s. 6d.; Friday, £228 5s. to £228 10s.; Monday, £229 to £229 5s.; Tuesday, £228 to £228 5s.; Wednesday, £228 17s. 6d. to £229 2s. 6d.

Three Months.—Thursday, £228 5s. to £228 7s. 6d.; Friday, £227 10s. to £227 12s. 6d.; Monday, £227 2s. 6d. to £227 7s. 6d.; Tuesday, £226 7s. 6d. to £226 10s.; Wednesday, £227 2s. 6d. to £227 5s.

Spelter.—There continues to be a fairly good industrial demand for zinc, but the market has nevertheless weakened in the face of increased selling pressure from abroad, and prices fell to a new record low level for the year. High-grade metal has been in slightly better call.

Day-to-day quotations :—

Ordinary.—Thursday, £13 1s. 3d.; Friday, £12 17s. 6d.; Monday, £12 13s. 9d.; Tuesday, £12 11s. 3d.; Wednesday, £12 7s. 6d.

Lead.—"The improvement in demand which has recently set in is being well maintained in this country, but the actual volume of business done has not been large. At the present level the market may be considered fairly healthy, because consumers do not need to economise, but, on the contrary, are finding new uses for the metal. This is particularly true in cases where lead is associated with tin in alloys. It is also reflected in the paint trade. Premiums of up to 15s. are now obtainable for prompt metal, duty free, in this country," state Messrs. Brandeis, Goldschmidt in their weekly report.

Price fluctuations have been as follow :—

Soft Foreign (Prompt).—Thursday, £10 8s. 9d.; Friday, £10 7s. 6d.; Monday, £10 3s. 9d.; Tuesday, £10; Wednesday, £10 1s. 3d.

Patent Specifications Accepted

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

409,983. KRUPP AKT.-GES. FRIEDRICH-ALFRED-HÜTTE, F. Process of and apparatus for the production of bent iron and steel sections.

409,984. TRIGGS, W. W. (International Patents Development Company). Machines for securing together two cup-like sheet-metal bodies.

410,044. MANNESMANNRÖHREN-WERKE. Pilger rolls.

410,085. LANGWORTHY, C. F., and HUGHES, H. WILSON-. Manufacture of galvanised-steel sheets.

410,104. DELLGREN, K. Method of coating iron or steel articles with aluminium.

410,111. STEWART & COMPANY, LIMITED, D., and HADDEN, W. M. Hydraulic-accumulator mechanism for the rolls of sugar-cane mills, rolling mills, and the like.

410,120. MANNESMANNRÖHREN WERKE. Pipe joints for metal pipes having a protective lining.

410,121. EVANS, O. (Vereinigte Stahlwerke Akt.-Ges.). Process for producing grooved rails and railway rails.

410,256. VEREINIGTE STAHLWERKE AKT.-GES. Production of substantially non-embrittling iron and steel.

410,262. INTERNATIONAL GENERAL ELECTRIC COMPANY, INC. Systems of electric welding.

410,323. BÜRSTENBINDER, R. Rust-preventing or rust-removing medium and a method of producing same.

410,520. ARMSTRONG, WHITWORTH & COMPANY (ENGINEERS), LIMITED, SIR W. G., and MCKINNELL, J. Rotary melting furnaces.

410,646. DEMAG-ELEKTROSTAHL GES. Apparatus for charging furnaces.

The Sir John Cass Institute

The Earl of Athlone, Chancellor of the University of London, will open the new wing of the Sir John Cass Technical Institute, Jewry Street, Aldgate, on October 10. The extension of the institute building was made possible when the governing body acquired from the Corporation of London the long lease of 2,000 years of adjoining properties. The new site measures approximately 5,000 sq. ft., and has allowed the frontage of the institute to be extended by about 75 ft. The new wing includes additional laboratories and lecture rooms for metallurgy, physics, organic and bio-chemistry. The increased floor space has enabled the governors to rearrange the interior of the original building and to provide a new geology classroom and museum, a new research laboratory, an enlarged laboratory for inorganic and physical chemistry, and new laboratories for metallography and pyrometry, assaying and mechanical testing.

XUM

BRITISH ROLL FOUNDRIES

ROLLTURNING SHOP OF MESSRS THOMAS PERRY & SON, LTD., BILSTON users of—

GENUINE
COLD BLAST PIG IRON

THE TOUGHEST AND STRONGEST OF BLAST FURNACE PIG IRONS

THE GENUINE COLD BLAST PIG IRONS
DUD · L.N.F'ces · DUD
LOWMOOR C.B.
GRAZEBROOK

THE EARL OF DUDLEY'S ROUND OAK WORKS, LTD.
BRIERLEY HILL, STAFFS.
Brand: "DUD·L.N.F'ces·DUD"

M. & W. GRAZEBROOK, LIMITED
DUDLEY, WORCS.
Brand: "GRAZEBROOK"

THE LOW MOOR IRON CO., LTD.,
NEW WORKS, LOW MOOR, BRADFORD - YORKSHIRE
Brand: "LOWMOOR C.B."

XUM

RAW MATERIALS—PRICE LIST

(Wednesday, September 12, 1934)

COPPER

	£	s.	d.
Standard cash	27	8	9
Three months	27	15	0
Electrolytic	30	10	0
Tough	29	5	0
Best selected	29	15	0
Sheets	58	0	0
India	40	0	0
Wire bars	30	15	0
Ingot bars	30	15	0
H.C. wire rods	33	5	0
Off. av. cash, August	28	7	10 1/11
Do., 3 mths., August	28	15	1 1/16
Do., Sttlmnt., August	28	7	10 1/11
Do., Electro, August	31	14	1 1/2
Do., B.S., August	31	9	8 3/8
Do., wire bars, August	31	18	7 7/11
Solid drawn tubes			9 1/2d.
Brazed tubes			9 1/2d.
Wire			6 1/4d.

BRASS

Solid drawn tubes	8 3/4d.
Brazed tubes	10 1/2d.
Rods, drawn	8 1/4d.
Rods, extd. or rlld.	4 1/2d.
Sheets to 10 w.g.	7d.
Wire	7 1/4d.
Rolled metal	6 3/4d.
Yellow metal rods	4 1/2d.
Do. 4 × 4 Squares	5 1/2d.
Do. 4 × 3 Sheets	5 1/2d.

TIN

	£	s.	d.
Standard cash	228	17	6
Three months	227	2	6
English	229	0	0
Bars	231	0	0
Straits	229	0	0
Australian (nom.)		—	
Eastern	230	5	0
Banca	230	0	0
Off. av. cash, August	228	4	1 3/32
Do., 3 mths., August	228	1	5 1/11
Do., Sttlmt., August	228	5	8 5/11

SPELTER

	£	s.	d.
Ordinary	12	7	6
Remelted	13	7	6
Hard	10	7	6
Electro 99.9	15	0	0
English	13	0	0
India	12	10	0
Zinc dust	17	0	0
Zinc ashes	3	0	0
Off. aver., August	13	14	4 1/2
Aver. spot, August	13	13	7 7/11

LEAD

	£	s.	d.
Soft foreign ppt.	10	1	3
Empire (nom.)	10	15	0
English	12	5	0
Off. average, August	10	18	5 1/16
Average spot, August	10	16	5 3/32

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	5	0
Do., V.M. ex-whse.	21	5	0
Rods	27	0	0

ANTIMONY

	£	s.	d.		£	s.	d.
English	43	0	0	to 45	0	0	
Chinese, ex-whse.					37	5	0
Crude						—	

QUICKSILVER

	£	s.	d.		£	s.	d.
Quicksilver	11	2	6	to 11	10	0	

FERRO-ALLOYS AND STEEL-MAKING METALS

	£	s.	d.
Ferro-silicon—			
25%	8	17	6
45/50%	13	0	0
75%	18	7	6
Ferro-vanadium—			
35/50%	12/8 lb. Va.		
Ferro-molybdenum—			
70/75% carbon-free	5/6 lb. Mo.		
Ferro-titanium—			
23/25% carbon-free	9d. lb.		
Ferro-phosphorus, 20/25%	£15	15	0
Ferro-tungsten—			
80/85%	3/- lb.		
Tungsten metal powder—			
98/99%	3/3 lb.		
Ferro-chrome—			
2/4% car.	29	15	0
4/6% car.	23	0	0
6/8% car.	21	12	6
8/10% car.	21	12	6
Ferro-chrome—			
Max. 2% car.	36	0	0
Max. 1% car.	38	15	0
Max. 0.70% car.	42	0	0
70%, carbon-free	10d. lb.		
Nickel—99.5/100%	£200 to £205		
"F" nickel shot	£184	0	0
Ferro-cobalt, 98/99%	5/3 lb.		
Metallic chromium—			
96/98%	2/5 lb.		
Ferro-manganese (net)—			
76/80% loose	£10 15 0 to £11	5	0
76/80% packed	£11 15 0 to £12	5	0
76/80% export (nom.)	£9	15	0
Metallic manganese—			
94/96% carbon-free	1/2 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under 1/8 in. to 1/4 in.	3d. lb.
Do., under 1/4 in. to 7/16 in.	1/- lb.
Flats, 1/8 in. × 1/4 in. to under 1 in. × 1/8 in.	3d. lb.
Do., under 1/4 in. × 1/4 in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£	s.	d.		£	s.	d.
South Wales—							
Heavy steel					2	15	0
Bundled shrngs.					2	7	6
Mixed iron and steel	2	8	0	to 2	11	0	
Heavy cast iron	2	7	6	to 2	8	6	
Good machinery	2	10	0	to 2	12	6	
Cleveland—							
Heavy steel					2	10	0
Steel turnings					1	15	0
Cast-iron borings					1	8	0
Heavy forge					2	10	0
W.I. piling scrap					2	5	0
Cast-iron scrap	2	10	0	to 2	12	6	
Midlands—							
Light cast-iron scrap					2	7	6
Heavy wrought iron					3	0	0
Steel turnings, f.o.r.					1	12	6
Scotland—							
Heavy steel	2	10	0	to 2	11	3	
Ordinary cast iron					2	12	0
Engineers' turnings					1	19	6
Cast-iron borings					1	19	6
Wrought-iron piling	2	11	3	to 2	12	6	
Heavy machinery	2	13	6	to 2	15	0	

London—Merchants' buying prices, delivered yard.

	£	s.	d.		£	s.	d.
Copper (clean)					25	0	0
Brass					16	10	0
Lead (less usual draft)					9	10	0
Tea lead					7	0	0
Zinc					9	0	0
New aluminium cuttings					66	0	0
Braziery copper					22	0	0
Gunmetal					22	0	0
Hollow pewter					145	0	0
Shaped black pewter					110	0	0

PIG-IRON

	£	s.	d.		£	s.	d.
N.E. Coast (d/d Tees-side area)—							
Foundry No. 1					70/-		
Foundry No. 3					67/6		
,, at Falkirk					67/3		
,, at Glasgow					70/3		
Foundry No. 4					66/6		
Forge No. 4					66/6		
Hematite No. 1					68/-		
Hematite M/Nos.					67/6		
N.W. Coast—							
Hem. M/Nos. d/d Glas.					72/6		
,, d/d Birm.					84/6		
Malleable iron d/d Birm.					115/-		
Midlands (d/d Birmingham dist.)—							
Staffs No. 4 forge					67/-		
,, No. 3 fdry.					71/-		
Northants forge					63/6		
,, fdry. No. 3					67/6		
,, fdry. No. 1					70/6		
Derbyshire forge					67/-		
,, fdry. No. 3					71/-		
,, fdry. No. 1					74/-		
Scotland—							
Foundry No. 1, f.o.t.					72/6		
,, No. 3, f.o.t.					70/-		
Hem. M/Nos. d/d					71/-		
Sheffield (d/d district)—							
Derby forge					64/6		
,, fdry. No. 3					68/6		
Lincs forge					64/6		
,, fdry. No. 3					68/6		
E.C. hematite					80/6		
W.C. hematite					83/6		
Lancashire (d/d eq. Man.)—							
Derby fdry. No. 3					74/-		
Staffs fdry. No. 3					74/-		
Northants fdry. No. 3					72/6		
Cleveland fdry. No. 3					74/-		
Dalzell, No. 3 (special)	102/6 to 105/-						
Glengarnock, No. 3					82/6		
Clyde, No. 3					82/6		
Monkland, No. 3					82/6		
Summerlee, No. 3					82/6		
Eglinton, No. 3					82/6		
Gartsherrie, No. 3					82/6		
Shotts, No. 3					82/6		

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	9	12	6	to 9	15	0	
Nut and bolt iron	7	10	0	to 8	0	0	
Hoops	10	10	0	and up.			
Marked bars (Staffs) f.o.t.				12	0	0	
Gas strip	10	10	0	and up.			
Bolts and nuts, 1/2 in. × 4 in.	14	0	0				
Steel—							
Plates, ship, etc.	8	15	0	to 8	17	6	
Boiler plts.	8	0	0	to 8	10	0	
Chequer plts.				10	7	6	
Angles				8	7	6	
Tees				9	7	6	
Joists				8	15	0	
Rounds and squares, 3 in. to 5/8 in.				9	7	6	
Rounds under 3 in. to 1/4 in. (Untested)				8	12	0	
Flats—8 in. wide and over				8	12	6	
,, under 8 in. and over 5 in.				8	17	6	
Rails, heavy	8	5	0	to 8	10	0	
Fishplates	12	5	0	to 12	10	0	
Hoops (Staffs)				9	7	0	
Black sheets, 24g. (4-t. lots)				10	10	0	
Galv. cor. shts. (,,)				13	0	0	
Galv. flat shts. (,,)				13	10	0	
Galv. fencing wire, 8g. plain				14	10	0	
Billets, soft	5	10	0	and up.			
Billets, hard	6	17	6	to 7	2	6	
Sheet bars	5	2	6	to 5	10	0	
Tin bars	5	2	6	to 5	7	6	

PHOSPHOR BRONZE

	Per lb. basis.
Strip	9d.
Sheet to 10 w.g.	10d.
Wire	11 1/4d.
Rods	10d.
Tubes	13d.
Castings	11d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1 1/4 to 1/7 1/4
To 15 in. wide	1/1 1/2 to 1/7 1/2
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2 1/2 to 1/8 1/2
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3 1/2
Ingots rolled to spoon size	10d. to 1/6 1/2
Wire round—	
to 10g.	1/4 1/2 to 1/11 1/2

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3 1/2 upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.26
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Bessemer	20.76
Malleable, Valley	18.50
Grey forge, Valley	18.25
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37 1/2
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.60
Plain wire	2.30
Barbed wire, galv.	3.00
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	19/- to 19/6
Durham foundry	20/- to 25/-
,, furnace	17/6
Midlands, foundry	—
,, furnace	—

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes 20×14 per box	18/2
,, 28×20 ,,	36/4
,, 20×10 ,,	26/1 1/2
,, 18 3/4×14 ,,	18/9
C.W. 20×14 ,,	15/9 1/2
,, 28×20 ,,	33/4 1/2
,, 20×10 ,,	22/7 1/2
,, 18 3/4×14 ,,	15/9 1/2

SWEDISH CHARCOAL IRON & STEEL

	£	s.	d.		£	s.	d.
Pig-iron	6	0	0	to 7	0	0	
Bars-hammered, basis	16	0	0	to 16	10	0	
Bars and nail-rods, rolled, basis	15	15	0	to 16	0	0	
Blooms	10	0	0	to 12	0	0	
Keg steel	30	0	0	to 31	0	0	
Faggot steel	18	0	0	to 23	0	0	
Bars and rods dead soft, st'l	10	0	0	to 12	0	0	

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£	s.	d.	
Sept.	6 ..	28	0	0	inc. 1/3
,,	7 ..	27	16	3	dec. 3/9
,,	10 ..	27	7	6	,, 8/9
,,	11 ..	27	6	3	,, 1/3
,,	12 ..	27	8	9	inc. 2/6

Electrolytic Copper

		£	s.	d.	
Sept.	6 ..	31	0	0	No change
,,	7 ..	31	0	0	,, ,,
,,	10 ..	30	10	0	dec. 10/-
,,	11 ..	30	10	0	No change
,,	12 ..	30	10	0	,, ,,

Standard Tin (cash)

		£	s.	d.	
Sept.	6 ..	229	5	0	inc. 10/-
,,	7 ..	228	5	0	dec. 20/-
,,	10 ..	229	0	0	inc. 15/-
,,	11 ..	228	0	0	dec. 20/-
,,	12 ..	228	17	6	inc. 17/6

Tin (English ingots)

		£	s.	d.	
Sept.	6 ..	229	10	0	inc. 10/-
,,	7 ..	228	10	0	dec. 20/-
,,	10 ..	229	5	0	inc. 15/-
,,	11 ..	228	5	0	dec. 20/-
,,	12 ..	229	0	0	inc. 15/-

Spelter (ordinary)

		£	s.	d.	
Sept.	6 ..	13	1	3	dec. 2/6
,,	7 ..	12	17	6	,, 3/9
,,	10 ..	12	13	9	,, 3/9
,,	11 ..	12	11	3	,, 2/6
,,	12 ..	12	7	6	,, 3/9

Spelter (Electro, 99.9 per cent.)

		£	s.	d.	
Sept.	6 ..	15	15	0	dec. 1/3
,,	7 ..	15	12	3	,, 3/9
,,	10 ..	15	6	3	,, 5/-
,,	11 ..	15	3	9	,, 2/6
,,	12 ..	15	0	0	,, 3/9

Zinc Sheets (English)

		£	s.	d.	
Sept.	6 ..	23	5	0	No change
,,	7 ..	23	5	0	,, ,,
,,	10 ..	23	5	0	,, ,,
,,	11 ..	23	5	0	,, ,,
,,	12 ..	23	5	0	,, ,,

Lead (English)

		£	s.	d.	
Sept.	6 ..	12	10	0	No change
,,	7 ..	12	10	0	,, ,,
,,	10 ..	12	5	0	dec. 5/-
,,	11 ..	12	5	0	No change
,,	12 ..	12	5	0	,, ,,

AVERAGE MONTHLY PRICES OF RUBIO ORE (MIDDLESBROUGH).

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1896	0 12 6	0 12 6	0 12 9	0 12 9	0 12 9	0 12 7	0 12 9	0 12 9	0 12 9	0 13 6	0 15 0	0 14 9	0 13 1
1897	0 15 3	0 15 6	0 15 3	0 15 0	0 14 0	0 14 3	0 14 3	0 14 0	0 14 0	0 15 0	0 14 3	0 15 3	0 14 8
1898	0 15 0	0 14 4	0 14 9	0 14 6	0 15 0	0 15 0	0 14 0	0 14 0	0 14 0	0 14 9	0 15 0	0 14 9	0 14 7
1899	0 15 0	0 15 3	0 15 6	0 15 9	0 15 9	0 16 0	0 17 6	0 18 0	0 17 9	0 18 0	0 19 0	1 0 0	0 16 11½
1900	1 1 0	1 0 6	1 1 0	1 0 9	1 1 0	1 1 0	1 1 3	1 1 6	1 1 3	1 1 3	1 0 0	0 18 0	1 0 8½
1901	0 17 6	0 16 0	0 15 0	0 14 6	0 15 6	0 15 9	0 14 9	0 15 3	0 15 9	0 15 9	0 15 9	0 15 9	0 15 7½
1902	0 15 6	0 15 0	0 16 0	0 16 0	0 15 6	0 15 3	0 15 6	0 16 0	0 16 0	0 16 0	0 15 9	0 15 6	0 15 8½
1903	0 15 6	0 16 0	0 16 6	0 16 3	0 16 3	0 16 10	0 15 9	0 15 6	0 15 6	0 14 9	0 14 9	0 15 1	0 15 8
1904	0 14 9	0 15 3	0 15 1	0 15 4	0 15 3	0 15 0	0 14 5	0 14 6	0 14 6	0 14 6	0 14 6	0 14 7	0 14 9½
1905	0 15 3	0 15 6	0 15 0	0 15 3	0 15 6	0 15 6	0 15 6	0 15 6	0 16 6	0 18 6	0 18 9	0 18 9	0 16 3½
1906	1 0 0	1 1 6	1 0 0	1 0 0	0 19 6	1 0 0	0 19 6	0 19 4	1 0 6	1 1 6	1 1 9	1 3 6	1 0 7
1907	1 3 6	1 2 6	1 2 0	1 2 0	1 1 6	1 2 3	1 2 3	1 2 0	1 1 0	0 19 0	0 18 9	0 17 6	1 1 2½
1908	0 16 6	0 15 0	0 15 6	0 15 6	0 15 3	0 15 0	0 15 0	0 14 9	0 15 0	0 16 0	0 16 0	0 16 0	0 15 8½
1909	0 15 9	0 16 3	0 16 0	0 16 0	0 16 3	0 16 6	0 16 0	0 16 0	0 17 0	0 17 0	0 17 6	0 17 6	0 16 6
1910	1 0 4	1 0 9	1 0 9	1 0 9	1 0 9	1 0 9	1 0 9	1 0 3	1 0 3	1 0 6½	1 1 3	1 1 5	1 0 9½
1911	1 2 2½	1 2 6	1 2 6	1 1 11½	1 0 11½	0 19 6	0 19 0	0 19 0	0 19 0	0 19 6	1 0 0½	1 1 6½	1 0 7½
1912	1 2 3	1 2 6	1 2 6	1 1 1½	1 1 6	1 1 6	1 1 6	1 2 3	1 2 6	1 3 0	1 3 0	1 2 11	1 2 3½
1913	1 2 9	1 2 2	1 1 7½	1 1 6	1 0 8½	1 0 0	1 0 0	1 0 0	0 19 10½	0 19 1½	0 19 0	0 19 0	1 0 3½
1914	0 18 7½	0 18 0	0 18 0	0 17 9	0 17 6	0 17 6	0 17 1½	0 19 7½	0 18 11½	0 17 10½	0 18 7½	1 1 0½	0 16 5½
1915	1 7 7½	1 8 6	1 9 3	1 10 2½	1 8 6	1 6 4	1 5 10½	1 6 0	1 6 10½	1 10 8½	1 13 0	1 17 10	1 9 1½
1916	1 18 6	2 0 1½	2 2 6½	2 0 6½	1 15 0	1 16 3	1 18 0	1 18 0	1 18 0	—	—	—	—
1917	Price Fixed												
1918													
1919	—	—	—	—	2 5 7½	2 14 4½	2 16 4½	2 14 0	2 13 4½	2 13 0	2 12 7½	2 11 9	—
1920	2 17 0	3 7 9	2 15 6	3 6 7	3 0 0	2 15 0	2 14 0	2 9 9	2 7 6	2 11 0	2 12 3	2 10 0	2 15 0
1921	2 1 0	2 0 1½	1 18 3	1 17 6	1 17 6	1 17 6	1 17 6	1 5 0	1 8 9½	1 7 9	1 7 0	1 7 0	1 13 8½
1922	1 6 7½	1 5 10½	1 6 11	1 7 0	1 7 0	1 7 6	1 5 3	1 4 9½	1 4 2½	1 3 3½	1 2 6	1 2 3	1 5 2½
1923	1 2 9½	1 4 6½	1 5 2	1 4 8½	1 4 6	1 4 0	1 3 6	1 3 0	1 3 0	1 3 0	1 3 2½	1 4 9	1 3 10½
1924	1 4 2½	1 4 0	1 4 0	1 3 7½	1 3 8½	1 3 6	1 2 11	1 2 6	1 2 1½	1 1 7½	1 2 3	1 2 6	1 3 1
1925	1 2 6	1 2 1½	1 2 0	1 2 0	1 2 0	1 1 6	1 0 6	1 0 0	1 0 0	1 0 0	1 0 3	1 0 10½	1 1 1½
1926	1 1 1½	1 1 6	1 1 6	1 1 3½	1 1 3	1 1 5½	1 1 6	1 1 6	1 1 0	1 1 6	1 1 6	—	1 1 4½
1927	1 2 1½	1 2 3	1 2 1½	1 2 0	1 2 0	1 2 0	1 1 7½	1 1 0	1 1 0	1 1 0	1 1 0	1 — 0	1 1 7½
1928	1 1 0	1 1 1½	1 1 11	1 2 4½	1 2 6	1 2 6	1 2 6	1 2 6	1 2 6	1 2 6	1 2 6	1 2 6	1 2 2½
1929	1 2 6	1 2 6½	1 2 11½	1 3 0	1 3 0	1 3 2½	1 4 0	1 4 8½	1 4 7½	1 4 6	1 4 6	1 4 3	1 3 7½
1930	1 3 3½	1 2 6	1 1 9	1 1 6	1 0 10½	1 0 0	1 0 0	0 19 6	0 19 0	0 17 4½	0 16 4½	0 16 4½	0 19 10½
1931	0 16 1½	0 16 0	0 16 0	0 15 11½	0 15 4½	0 15 0½	0 14 10½	0 14 3½	0 14 6	0 16 8½	0 17 0½	0 16 6	0 15 9
1932	0 16 6	0 16 6	0 16 3	0 15 6	0 15 4½	0 15 0	0 14 11	0 14 8½	0 14 6	0 14 6	0 14 9	0 15 1	0 15 3½
1933	0 15 6	0 15 3	0 15 3	0 15 3	0 15 3	0 15 6	0 15 6	0 15 6	0 15 6	0 15 11½	0 16 6	0 16 6	0 15 7½
1934	0 16 6	0 17 6	0 16 9	0 16 6½	0 16 8½	0 16 9½	0 17 0	0 17 0	—	—	—	—	—

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10" Rotary CUTTING-OFF MACHINE, 2 speed belt dr.

"Weir" Vert. D.A. BOILER FEED PUMP, 18" dia., cyl. 22" str.; 14,600 galls.: 6" suc., 5" del.

3 LANCS BOILERS, 30' x 8', 200 lbs. w.p.

Write for "Albion" Catalogue.

'Grams: "Forward." 'Phone: 23001 (10 lines).

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This Week's Bargain

Complete Plant comprising the following:—
Re-conditioned.

1 Sand-blast Chamber, 4 ft. 6 in. x 4 ft. 6 in. x 3 ft.
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1 Tilghman Air Compressor, 130 cub. ft. per min. at 30 lbs. pressure.
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STEEL Hand Travelling Crane; hoist 6 tons, span 37' 9". £22 10s.

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Smith's Hearth, by Keith Blackman. £5.

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Room, Rotary Barrel and Cabinet Types complete; 12 in stock.

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Sand Mills, 6-ft., 5-ft. and 4-ft. 6-in. dia. Pans.
Rotoil "Senior" Oil Core Sand Mixer.
Pneulec Sand Drying Plant, output 1 ton per hour
Brearley Type Disintegrators.

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Hand and Pneumatic Types.
Also
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Electrical and Belt-driven Blowers and Exhaust Fans, Ladles, etc., etc.

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By Order of TRIPLEX FOUNDRY, LIMITED, of Great Bridge, Staffordshire (makers of Patent Triplex Grates), who have removed to their New Works in the same area.

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About 7½ miles from Birmingham and 5½ miles from Wolverhampton.

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Total Area of 17,900 Square Yards or thereabouts, with Excellent Road and Canal Frontages, and comprising Manufacturing Premises with an Excellent Block of Modern Offices:

A Capital Foundry
With First-class Melting Plant,
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18" × 36" TABOR rollover shockless.
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12' × 9' Tilghman sandblast room, built of cast iron plates, complete with 400 cu. ft. Tilghman air compressor and all accessories **£290 Nett.**
T.B. 1 Tilghman sandblast barrel plant, complete.
T.B. 3 Tilghman barrel plant, 2 jet, complete.
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